TECHNICAL SPECIFICATIONS FOR PROGRAM DELIVERY

Version 7.0,
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Prepared by the CBC/Radio-Canada
Working Group on UHD/HD/SD standards

CBC Radio-Canada

Version 7.0 – Change summary

Main changes included in this version since the last revision:

- Emphasize the fact that 5.1 is the preferred audio mix for HD programs
- Modify the maximum audio True Peak value for the audio excerpts, podcasts or audiobooks
- Clarify editing requirements for content delivery that include sources with multiple frame rates.
- Clarify STC's language for international distributors.
- SD content - Correct a typo error for the audio content requirements
- Update SMPTE standards revision dates cited in the document and add the reference for UHD color bars.
- Update Web Exclusives section (time code now is required to start at 00:00:00:00)

It is strongly recommended to go through the document to know what has been updated or modified.

Acknowledgments

This document was written with the collaboration of people from various departments within CBC/Radio-Canada. We acknowledge the contribution of the working group members of the following departments for their valuable input:

- English Services
- French Services
- Technology and Infrastructure

Questions?

For any questions about the document please write to one of the following Email addresses:

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SUMMARY

FOR PROGRAM DELIVERY TO
CBC, CBC News, Gem, ICI Radio-Canada Télé, ICI RDI, ICI Explora, ICI Artv, or ICI tou.tv

The following file package shall be provided for any program delivery.

QTY	FILE DESCRIPTION	ACCEPTED FILE EXTENSIONS
1	Video/Audio File - original format	[PGM ID].MXF (preferred)
1	Metadata File	[PGM ID].XML
1	Gallery	[PGM ID]_Gallery.JPEG
4	Still Images	[PGM ID]_Still_1.JPEG etc.
1	CC should be embedded in .mxf file Closed caption file (for .mov file only)	 [PGM ID].scc (along with .mov file only)

Format	FILE WRAPPER	VIDEO CODING	AUDIO CODING	CLOSED CAPTION
HD	.MXF	XDCAM HD422 50Mbps (in-house, preferred)	PCM	Embedded
HD	.MXF	XAVC-I 100 (progressive scan preferred)		Embedded
HD	.MOV	Apple ProRes (422 or 422 HQ)	PCM	Separate .scc file
UHD	.MXF	XAVC UHD Long GOP 200	PCM	Embedded
SD	.MXF	IMX 50Mbps (preferred)	PCM	Embedded (CC on Line 21 accepted)
SD	.MOV	Apple ProRes (422 or 422 HQ)	PCM	Separate .scc file

HD VIDEO ESSENCE	
Video – HD	- 1920 x 1080, 4:2:2, color space compliant with Rec. ITU-R BT.709 - Quantizing: 8-bit (XDCAM HD422) and 10-bit (XAVC-I and Apple ProRes)
Frame Rate/ Scan Type	- Content shall be delivered with its **original frame rate** and scan type. - Accepted frame rates and scan types: 29.97i (In-house standard), 23.976p, 25i, 25p, 29.97p. - Progressive scan preferred for the XAVC-I 100 codec - Constant frame rate from the beginning of the leader up to the end of the trailer. - Interlaced scan shall be upper field first
Timecode	Present, continuous (from start to end), for 29.97fps use the 'drop frame' mode.

CLOSED CAPTION ESSENCE	
.scc file	- CC formatted for a 29.97fps Drop Frame timecode regardless of the video frame rate of the provided file. - The CC shall be delivered in English to CBC and in French to Radio-Canada.

UHD VIDEO ESSENCE	
Video - UHD	3840 x 2160, 4:2:2, 10-bit
	Color space in compliance with Rec. ITU-R BT.709
Frame Rate/ Scan Type	- Content shall be delivered with the progressive scan mode and its **original frame rate**. - Constant frame from the beginning of the leader up to the end of the trailer. - Accepted frame rates: 29.97p (In-house standard), 23.976p, 25p.
Timecode	Present, continuous (from start to end), for 29.97fps use the 'drop frame' mode.

AUDIO ESSENCE	
Audio	PCM, 24bits, 48kHz
	5.1 audio mix (preferred) delivered on 6 channels with a stereo mix for Described Video If this requirement cannot be met, contact CBC/R-C to get the approval to provide a mix with less channels.
	- CBC: 8 channels 1:L 2:R 3:C 4:LFE 5:Ls 6:Rs 7:DV-L 8:DV-R - R-C: 10 channels 1:L 2:R 3:C 4:LFE 5:Ls 6:Rs 7:DV-L 8:DV-R 9:Lo 10:Ro
	- Peak values -2dBTP Max. - Integrated program loudness: -24LKFS +/-2LU (per segment reading) - Dialog loudness: -24LKFS +/-2LU (per segment reading)
Described Video	If no DV is available, a stereo mix of the program is required on tracks 7 and 8.

DIGITAL EXCLUSIVES
does not include Gem or tou.tv

All HD and UHD file specifications listed above apply except for the following items:

AUDIO/VIDEO CONTENT	
4:3 content and Social Media Formats Image Display	4:3 content and social media formats (1x1, 4x5, 2x3, 9x16, etc.) must be pillarboxed into a 16:9 frame.
Program Structure	- **No leader, maximum 1-second black/silence after the program** - The file shall contain 1 program segment per file - The Time Code starts at 00:00:00:00

Audio excerpts, podcats or audiobooks

AUDIO ONLY CONTENT	
Audio	24bits, 48kHz, stereo (1:L 2:R) Integrated Program loudness: -24LKFS +/-2LU, -10dBTP max.
File Structure	No silence (leader), program, no silence (trailer)
File Format	Uncompressed Linear PCM (.wav) Preferred

Legacy SD Content

SD VIDEO/AUDIO ESSENCE	
Video – SD	720x486 NTSC or 720x576 PAL (4:3 or Anamorphic 16:9 SD), 4:2:2 with 8/10-bit quantizing
	Color space in compliance with Rec. ITU-R BT.601
Frame Rate/ Scan Type	- Content shall be delivered with its **original frame rate** and scan type. - The frame rate shall remain constant from the beginning of the leader up to the end of the trailer. - Accepted frame rates and scan types: 29.97i (In-house standard), 23.976p, 25i, 25p, 29.97p. - Interlaced scan shall be upper field first
Audio	PCM, 24bits, 48kHz, -2dBTP Max.
	A stereo mix (Lo Ro) and a stereo mix for DV
	- Stereo program: 1:L 2:R 3:DV-L 4:DV-R
	Integrated Program loudness: -24LKFS +/-2LU & dialog loudness -24LKFS +/-2LU
Described Video	If no DV is available, a stereo mix of the program is required on tracks 3 and 4.
Timecode	Present, continuous (from start to end), for 29.97fps use the 'drop frame' mode.
AFD Value	Not required. The AFD value is inserted by CBC/Radio-Canada.

1 Scope

The technical specifications defined in this document apply to the video programs delivered to the English and French networks of CBC/Radio-Canada. The content is intended for distribution on all delivery platforms. The specifications are detailed in sections 1 to 12 (included) and they apply to the following services:

Network type	English	French
General	CBC	ICI Radio-Canada Télé
News	CBC News	ICI RDI
Streaming	Gem	ICI tou.tv
Specialized	--	ICI Explora, ICI Artv

The last section of the document, section 13, details the specifications for the Digital Exclusives. They apply to content destined for the Web but exclude Gem and tou.tv.

The delivery specifications for commercials are specified in a separate document. CBC/Radio-Canada reserves the right to reject any production that fails to meet the specifications described in this document.

2 File Delivery

2.1 CONTENT DELIVERY – FILE PACKAGE TO PROVIDE

The following file package shall be provided for any program delivery.

QTY	FILE DESCRIPTION	SPECIFICATIONS REFERENCE
1	A/V File - original format With embedded closed caption (for .mxf files only)	Section 3
1	Metadata File	Section 10
1	Gallery Image	Section 6
4	Still Images	Section 6
1	Closed caption file (for .mov file only)	Section 4

2.2 DELIVERY PROCEDURE

Program providers shall contact CBC/Radio-Canada for information about the primary and backup delivery method.

- For CBC: cbcprogramdelivery@cbc.ca
- For Radio-Canada: specs-techs@radio-canada.ca

For new or small distributors, CBC/Radio-Canada is requesting that a file delivery test be done with a short representative sequence that lasts approximately 5 minutes to validate the format.

2.3 PROGRAM FILE NAMING CONVENTION

The file name shall clearly identify the program. The file name, noted as [PGM ID] in this document, shall include the following information:

ORDER	ELEMENT in [PGM ID]	OPTIONS
1st	Network	CBC, RC
2nd	Content type	SERIES, FILMS, DOCS
3rd	Program/Series Title	na
4th	Season Number (if applicable)	na
5th	Episode Number (if applicable)	na

Additionally:

- The elements in the file name shall be separated by an underscore symbol « _ ».
- The file name shall not contain any accent, special character or space.
- The maximum length of the complete file name shall not exceed 80 characters.

Ex:	RC_SERIES_TheShowXYZ_S02_E04.mxf	'The Show XYZ', Season 2, Episode 4
	CBC_FILMS_TheMovieXYZ.mxf	The film title 'The movie XYZ'
	CBC_DOCS_TheDocXYZ .mxf	The documentary title 'The doc XYZ'

3 File Wrappers and Codecs

The following HD/UHD file formats are accepted. Other file types shall be approved within the contractual agreement.

3.1 HD FILE CONTENT

In case of problems with the file delivery, CBC/Radio-Canada has set up a backup file delivery method. Program providers shall contact CBC/Radio-Canada for additional information in this respect.

3.1.1 Preferred format: MXF wrapper – XDCAM HD422

PARAMETER	SPECIFICATION
File Wrapper	MXF (.MXF) See section 3.4 for wrapper requirements.
Timecode	• 1 authoritative timecode representation in the file • The MXF file shall contain 1 Timecode Track in the Material Package, per SMPTE ST 377-1:2019 • See section 7.3 Program Structure for starting TC value • For the 29.97 frame rate, use the 'drop frame' time code mode
Video	CODEC: **XDCAM HD 422 @ 50 Mbps** **PREFERRED CODEC** ESSENCE: **1080 (original frame rate and scan type)** See Section 7 for detailed specs
Audio	CODEC: **Linear PCM, 48kHz, 24bits** ESSENCE: See section 8 for detailed specs Each MXF track must contain only one audio channel, in compliance with SMPTE ST 382:2007.
Closed Captions	Embedded in the MXF file as a Data Track in the Material Package, in compliance with SMPTE ST 436-1:2013.

3.1.2 2nd accepted format: MXF wrapper – XAVC-I 100

PARAMETER	SPECIFICATION
Wrapper, Timecode, Audio, Closed Captions	Same as above (section 3.1.1)
Video	CODEC: **XAVC-I 100** ESSENCE: **1080p (progressive scan preferred)** original frame rate See Section 7 for detailed specs

3.1.3 3rd accepted format: QUICKTIME wrapper – Apple ProRes

PARAMETER	SPECIFICATION
File Wrapper	QuickTime (.MOV)
Timecode	• A timecode track shall be present within any QuickTime file and continuous from the beginning of the leader up to the end of the trailer. • See section 7.3 Program Structure for starting TC value • For the 29.97 frame rate, use the 'drop frame' time code mode
Video	CODEC: **Apple ProRes (422 or 422 HQ)** ESSENCE: See Section 7
Audio	CODEC: **Linear PCM, 48kHz, 24bits** ESSENCE: See section 8
Closed Captions	Delivered in separate *.scc file. See section 4 for specifications.

3.2 UHD FILE CONTENT

PARAMETER	SPECIFICATION
File Wrapper	MXF (.MXF) See section 3.4 for wrapper requirements.
Timecode	• 1 authoritative timecode representation in the file • Present, continuous in the timecode Track in the Material Package of the MXF file, in compliance with SMPTE ST 377-1:2019. • See section 7.3 Program Structure for starting TC value • For the 29.97 frame rate, use the 'drop frame' time code mode
Video Codec	CODEC: **XAVC UHD Long GOP 200** (per SMPTE RDD 32:2017) ESSENCE: **2160p (original frame rate)** See Section 7 for detailed specs
Audio Codec	CODEC: **Linear PCM, 48kHz, 24bits** ESSENCE: See section 8 for detailed specs Each MXF track must contain only one audio channel, in compliance with SMPTE ST 382:2007.
Closed Caption	Embedded in the MXF file as a Data Track in the Material Package, in compliance with SMPTE ST 436-1:2013.

3.3 SD FILE CONTENT

CBC/Radio-Canada will accept native Standard Definition (SD) content delivery in special cases; for example, legacy content or archival material. Any delivery of SD content shall be approved by CBC/Radio-Canada. The following SD file formats are accepted. Other file types shall be approved within the contractual agreement.

3.3.1 Preferred format: MXF wrapper - IMX

PARAMETER	SPECIFICATION
File Wrapper	MXF (.MXF) See section 3.4 for wrapper requirements.
Timecode	• 1 authoritative timecode representation in the file • Present, continuous in the timecode Track in the Material Package of the MXF file, in compliance with SMPTE ST 377-1:2011. • See section 7.3 Program Structure for starting TC value • For the 29.97 frame rate, use the 'drop frame' time code mode
Video Codec	CODEC: **IMX @ 50 Mbps** ESSENCE: See section 11
Audio Codec	CODEC: **Linear PCM, 24bits, 48kHz** ESSENCE: See section 11 Since the .imx file format is older and in it the audio channels are included on 1 track, this structure was kept in the .mxf file. Therefore, unlike HD files, audio channels must be included on an MXF track, according to SMPTE ST 382:2007.
Closed Caption	Embedded in the MXF file as a Data Track in the Material Package, in compliance with ST 436-1:2013.

3.3.2 2nd accepted format: QUICKTIME wrapper – Apple ProRes

PARAMETER	SPECIFICATION
File Wrapper	QuickTime (.MOV)
Timecode	• A timecode track shall be present within any QuickTime file and continuous from the beginning of the leader up to the end of the trailer. • See section 7.3 Program Structure for starting TC value • For the 29.97 frame rate, use the 'drop frame' time code mode
Video	CODEC: **Apple ProRes (422 or 422 HQ)** ESSENCE: See Section 11
Audio	CODEC: **Linear PCM, 48kHz, 24bits** ESSENCE: See section 11
Closed Captions	Delivered in separate *.scc file. See section 4 for specifications.

3.4 MXF WRAPPER

3.4.1 Requirements

MXF (Material eXchange Format) is an open file format targeted at the exchange of audio-visual content with associated metadata. Due to the wide coverage of this standard, constraints are added to create a subset of this format and thus simplifying equipment interoperability.

CBC/R-C requires that any MXF file wrapper complies:

- With MXF OP1a, as defined in SMPTE ST 378:2004;
- With the constraints defined in AMWA AS-11's document, sections 6.1.1 to 6.1.8 (see table below).

AMWA AS-11 SECTION	DESCRIPTION
6.1.1 General	'Files shall contain a single program comprised of video, audio and other ancillary data'
6.1.2 Interleaving	'Essence in container shall be frame-wrapped'
6.1.3 Partitioning	CBC/Radio-Canada accepts single or multiple partitions files. 'It is recommended that new' body 'partition should be started each 1min. of program time. Partition should not be longer than 10min of program time, and new partition may be started to meet this requirement. The Header Partition shall be marked closed and complete.'
6.1.4 Index Table	'Files shall include full MXF Index Tables. The full Index Tables shall index every frame of every Track in the file.'
6.1.5 Container	'Files shall use the MXF Generic Container SMPTE ST 379-2:2010.'
6.1.6 System Item	NA/Optional
6.1.7 RIP	'Files shall contain a Random Index Pack per SMPTE ST 377-1:2011.'
6.1.8 KAG Size	'AS-11 Files shall employ the default KLV Alignment Grid of 1 unless this requirement conflicts with an underlying essence container specification. When a conflict exists, the value in that essence container specification shall be used.'

Note: Most non-linear editing systems are capable of exporting files that comply with these specifications.

3.4.2 MXF File – Timecode

The equipment used at CBC/R-C reads the timecode at one authoritative location.

The timecode shall be inserted in the file header, where the timecode is represented by Metadata, often referred to as Synthetic TC (as defined in SMPTE ST 377-1:2011). The metadata is using an MXF Timecode track.

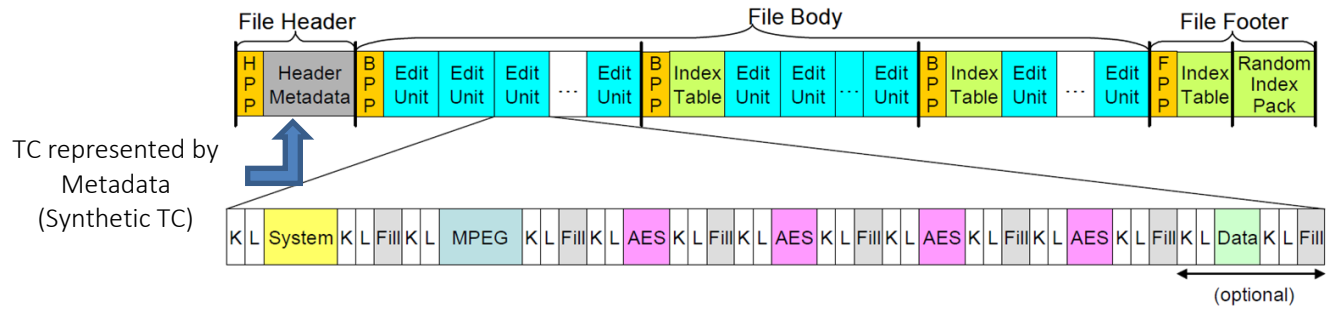


Figure 1 – Outline of MXF File

Reference:
Picture taken from SMPTE RDD9-2013

Timecode inserted at any other places in the file will be ignored.

4 Closed Captions

All programs delivered to CBC/Radio-Canada shall include Closed Captions. It shall be delivered in English to CBC and in French to Radio-Canada.

- For **.MXF file,** the Closed caption shall be **embedded** in the MXF file as a Data Track in the Material Package, in compliance with SMPTE ST 436-1:2013.

- For **MOV files****, a **separate Closed captions file** shall be provided separately from the program file and the associated CC timecode shall match the video timecode. The closed captions must be formatted for a 29.97fps Drop Frame timecode regardless of the video file's frame rate. The acronym SCC stands for Scenarist Closed Caption format and [PGM ID] is defined in section 2.3

- For **Digital exclusives**: only .MXF files embedded cc will be processed. No separate cc files accepted.

Closed Caption data packet structure:

Regardless of the file format used to carry the Closed Caption, the Closed Caption shall be encoded as data packets, per ST 334-1:2007. The closed captions shall be of EIA 608 type encapsulated into EIA 708 data, in compliance with the EIA 708 standard.

5 Credits

All credits shown in vertical scroll shall be produced in a way that makes them clearly readable when viewed at a frame rate of 29.97i and be free of judder or blur.

If it is not possible to meet this requirement, like it could happen for programs originally shot at other frame rates than 29.97i, the credit information shall be displayed on separate pages.

6 Gallery and Still Images

Each video file shall be delivered with the following accompanying images. These images will be posted on CBC/Radio-Canada's Web portal to advertise the program.

QUANTITY	IMAGE CONTENT	DESCRIPTION
1	Gallery	Artistic image representing the main character(s) and/or important elements of the movie.
4	Still images	Selection of images extracted from the movie file presenting different moments of the story.

PARAMETER	GALLERY Image	**STILL** Images
File format	[PGM ID]_Gallery.JPEG *	[PGM ID]_Still_n.JPEG *
Width/Height	1920 x 1080 or higher	1920 x 1080 or higher (16:9 content) 1440 x1080 or higher (4:3 content)
Aspect Ratio	Perfect 16:9 ratio	Same as video source: 16:9(HD) or 4:3(SD)
Resolution	300ppi	300ppi
Color Mode	RGB Color (8 bits/ channel)	RGB Color (8 bits/ channel)

* [PGM ID] is defined in section 2.3 and "n" refers to the picture number.

The images shall not:

- Depict scenes where drug, suicide, violence, horror, nudity or any troubling situations are more graphic;
- Contain weapons pointing at camera;
- Show program spoilers;
- Contain any text, legal lines, or logos.

Additionally:

- The image luminosity shall be sufficient.
- The image borders shall not present special effects.

7 Video Essence

7.1 HIGH DEFINITION (HD) Video Standard

7.1.1 HD In-house Video Format

All HD material delivered to CBC/Radio-Canada shall meet the following specifications.

PARAMETER	SPECIFICATION
Video format	The video format described herein corresponds to: SMPTE ST 274:2008 Table 1, line 5
Image format	1920 x 1080 pixels
Sampling structure	• 4:2:2 with 8 or 10-bit quantizing depending on the codec that is used • These image specifications should be preserved as much as possible throughout the complete production process.
Scanning mode and frame Rate	29.97 frames per second, constant, **interlaced (preferred format)** • Although the in-house frame rate is 29.97fps interlaced, any content shall be delivered with its **original frame rate and scan type**. The conversion will be done internally when necessary. • See section 7.1.2 for content not originally shot at 29.97i
Field Dominance	• Interlaced type HD content shall be delivered with a field order where the upper field is dominant (upper field first). • Cuts in material must happen on frame boundaries i.e. between field 2 and field 1.
Color Space	In conformance with Rec. ITU-R BT.709

7.1.2 Requirements for content not originally shot at 29.97i

If all the source material is in the same frame rate

Any production originally shot and/or edited at a different frame rate and scan type than 29.97fps, interlaced, shall be delivered to CBC/R-C in its original format. The frame rate shall remain constant from the beginning of the leader up to the end of the trailer.

The other frame rates and scan types that will be accepted are: 23.976p, 25i, 25p and 29.97p.

If the source material is in more than one frame rate

Editing and delivery must be done at a scan mode and frame rate of 29.97i in the case where sources used to create the program have different frame rates (e.g. 23.976p stock footage and 29p interviews), in order to provide an adequate frame rate conversion (see 2:3 Pulldown section 7.1.3).

7.1.3 Content Conversion Requirements

Film-originated Material

When movies and other productions shot on film or using digital technologies equivalent to film are converted to HD and delivered to CBC/Radio-Canada for broadcast, the aspect ratio conversion shall preserve the complete original picture area. Therefore, **"**pan and scan**"** is not accepted.

The appropriate aspect ratio conversion mode shall be selected according to the following table:

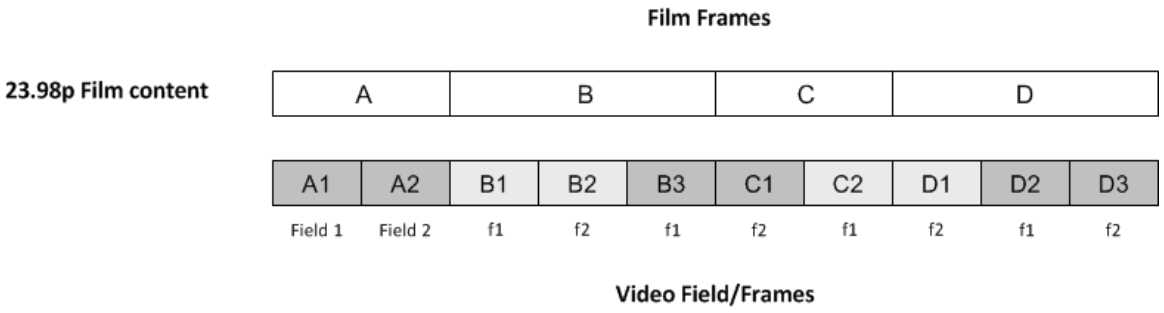
ORIGINAL FILM ASPECT RATIO	ASPECT RATIO CONVERSION MODE FOR 16:9	**MOVIES** Accepted Aspect Ratios	**DRAMAS** Accepted Aspect Ratios
1.78 (16:9)	Equivalent	✔	✔
1.85	Letterbox	✔	✔
2.0	Letterbox	✔	✔ (max)
2.39*	Letterbox	✔	Not accepted

* This production aspect ratio is often mislabeled "2.35".

In all cases, no alteration of the original horizontal/vertical proportions (geometric distortion) shall be tolerated.

2:3 Pulldown

The 2:3 pulldown (commonly referred to as 3:2 pulldown), used to convert 4 film frames into 5 video frames, shall be as described in SMPTE RP 197:2003. If 4 film frames are represented as A, B, C, D, the pulldown sequence of the video fields generated from them shall be:



This 2:3 sequence shall be respected not only for film transfers but also for frame rate conversions performed with any other system (standard converters, non-linear editing systems, etc.). It will ensure a fluid perception of movements.

7.1.4 Use of original SD material in an HD program

Use of native SD visual sequences, including NTSC, PAL or SECAM analog video, or ITU-R BT.601 digital video, is accepted only in special cases; for example, insertion of archival material. The producer shall inform CBC/Radio-Canada of, among other things, the total anticipated length of up-converted SD video material to be inserted into the HD program, and clearly justify its use. Any use of SD sequences in an HD program shall be approved by CBC/Radio-Canada.

When original 4:3 SD materials are converted to 16:9 HD for insertion in an HD program, an SD- to-HD converter with an appropriate performance must be used to ensure a clean resizing of the images is performed (no defect on all picture edges and no Closed Captions signal on top of active picture area).

In all cases of SD to HD up-conversion, no alteration of horizontal versus vertical proportions (geometric distortion) shall be tolerated.

For 4:3 SD Material

- Care must be taken to remove CEA-608 closed captioning signals from lines 21 and 284 of the SD frames before conversion.
- The pillarbox aspect ratio conversion shall be used.
- Conversion by horizontal stretching is prohibited.

For 16:9 SD Material

- The aspect ratio conversion shall be such that the 16:9 SD image be enlarged to fill the 16:9 HD frame.
- When both anamorphic and letterboxed 16:9 SD materials are available, CBC/Radio-Canada recommends using the anamorphic material as the source for up-conversion in preference to letterbox.

7.1.5 HD: Safe Action and Safe Title areas

CBC/Radio-Canada recommends, in accordance with SMPTE ST 2046-1:2009, the following safe areas:

AREA	SPECIFICATION
Safe Action	The main action shall be framed inside a central zone of height **93%** by width **93%** of the full HD picture.
Safe Titles	All titles shall be framed inside a central zone of height **90%** by width **90%** of the full HD picture.

7.2 ULTRA HIGH DEFINITION (UHD) Video Standard

7.2.1 UHD in-house video format

All UHD material delivered to CBC/Radio-Canada shall meet the following specifications.

PARAMETER	SPECIFICATION
Video format	The video format described herein corresponds to: SMPTE ST 2036-1:2014 Table 1, line 4
Image format	3840 x 2160 pixels
Sampling structure	• 4:2:2 with 10-bit quantizing • These image specifications should be preserved as much as possible throughout the complete production process.
Scanning mode and frame Rate	29.97 frames per second, constant, **progressive** (In-house format) • Although in-house frame rate is 29.97fps progressive for UHD content, any content shall be delivered with its **original frame rate** and scan type. The conversion will be done internally when necessary • See section 7.2.2 for content not originally shot at 29.97p
Color Space	In conformance with Rec. ITU-R BT.709

7.2.2 Requirements for content not originally shot at 29.97p

Any production originally shot and/or edited at a different frame rate and scan type than 29.97fps, progressive, shall be delivered to CBC/R-C in its original format. The frame rate shall remain constant from the beginning of the leader up to the end of the trailer.

The other frame rates and scan types that will be accepted are: 23.976p and 25p.

7.2.3 Film-originated Material

Any content delivered with a different image format than UHD 3840x2160, for example 4K content at 4096x2160, will be center cropped to meet the in-house UHD image format (3840x2160). **"**Pan and scan**"** or letterboxing will not be performed.

7.2.4 UHD: Safe Action and Titles Area

SMPTE has not issued a recommendation up to this date. In the meantime, CBC/Radio-Canada recommends, in accordance with ITU-R recommendation BT.1848-1 (10/2015), the following safe areas:

AREA	SPECIFICATION
Safe Action	The main action shall be framed inside a central zone of height **96.5%** by width **96.5%** of the full UHD picture.
Safe Graphics and Titles	All graphics and titles shall be framed inside a central zone of height **95%** by width **95%** of the full UHD picture.

7.2.5 Use of original HD or SD material in a UHD production

Use of HD Content

Use of native HD visual sequences are accepted only in special cases in a UHD program; for example, insertion of archival material. The producer shall inform CBC/Radio-Canada of, among other things, the total anticipated length of up-converted HD video material to be inserted into the UHD program, and clearly justify its use. Any use of **HD sequences** in an UHD program shall be approved by CBC/Radio-Canada.

When original HD material is converted for insertion in a UHD program, HD- to- UHD conversion must be done to ensure clean image resizing with no defect on picture edges. In all cases of HD to UHD up-conversion, no alteration of horizontal versus vertical proportions (geometric distortion) shall be tolerated.

Use of SD Content

CBC/Radio-Canada does not recommend the use of native **SD content** to be inserted into a UHD program. If for extraordinary reasons it is approved:

- The SD content should be “windowed” (picture in picture) in the UHD image with a reasonable size to be able to see correctly the SD content while minimizing the visual artefacts.
- The SD image should not be scaled beyond HD
- Refer to section 7.1.4 for the details on how the conversion process shall be performed.
- The SD content frame rate should not be interlaced

7.3 PROGRAM STRUCTURE

Programs delivered on file shall include leaders and trailers as described in the following table:

TIME CODE (at start)	DURATION (seconds)	AUDIO	VIDEO	FILE
09:59:30:00	5	Reference tones	Slate	Leader
09:59:35:00	20	Vocal Track ID/Pink Noise		
09:59:55:00	3	Silence	Black	
09:59:58:00	1 frame	1 kHz @ reference level (audio/video Synchro.)	Colour bars (audio/video Synchro.)	
09:59:58:01	2	Silence	Black	
10:00:00:00	----	Program Segment # 1	Program Segment # 1	----
----	1	Silence	Black	----
----	----	Program Segment # 2	Program Segment # 2	----
----	1	Silence	Black	Trailer

Digital Exclusives: The program structure is different. (see section 13 for details).

Reference Tones

- A reference tone shall be in phase and be on all audio channels used for the program, including described video and for the stereo mix on tracks 9 and 10 (for French Services).
- The reference tone level shall be consistent with the recorded program.
- Unused channels shall be silent.

Vocal Track Identification

- A vocal track identification shall be present on all audio channels used for the program, including described video and for the stereo mix on tracks 9 and 10 (for French Services).
- It shall be clear, precise and sequential, such that track allocation is easily identifiable.
- The Vocal ID shall be followed by a short pink noise burst at reference level on each channel.

Colour bars

The color bars must compliant with:

- SMPTE RP219-1:2014 for HD and SD content

- SMPTE RP219-2:2016 for UHD content

Slate

See next page.

Slate

The slate shall include the following information:

- Program title/Series name
- Season number, episode title/number
- Producer's name and contact
- Main program audio type (mono, stereo, multichannel)
- Audio track allocation (including DV)
- Integrated loudness value (in LKFS)
- Program length (H:M:S)
- Segment #1 start Time Code
- Segment #2 start Time Code, etc.
- Described video (Yes, No).
- Original aspect ratio (4:3 or 16:9)

7.4 VIDEO FORMAT IDENTIFICATION

Whenever the video format identification is required (for example in the metadata file, the slate, etc.), the video format shall be identified using the following notation: **LLLL S FF**

Where: **LLLL** Number of active **l**ines per frame
S **S**can mode
FF **F**rame rate (not field rate)

Ex: 1080 i 29.97, 1080 p 29.97

7.5 UD/UHD SUBJECTIVE QUALITY ASSESSMENT

The image quality of HD and UHD programs provided shall be evaluated according to the five-point scale suggested in the International Telecommunication Union ITU-R BT.500-14 standard:

RATING	IMPAIRMENTS	QUALITY
5	Imperceptible	Excellent
4	Perceptible but not annoying	Good
3	Slightly annoying	Fair
2	Annoying	Poor
1	Very annoying	Bad

Programs should meet the criteria for a 5 rating.

Exceptionally, on program portions including, for example, archival material, the minimum acceptable quality shall be a 3 rating for HD content and a 4 rating for UHD. This type of content shall be approved within the contractual agreement.

8 AUDIO ESSENCE

CBC/Radio-Canada reserves the right to reject productions that do not meet the criteria described herein.

8.1 PROGRAM VERSIONS

CBC/Radio-Canada **recommends** producing **HD** programs with **5.1 multichannel audio** for several reasons:

- The 5.1 program is the best mix that offers a full immersion and movie theater like experience at home, which pure stereo production cannot offer since all elements (dialogs, music, sound effects) are mixed on only 2 channels.
- Any program, except news, would benefit from an immersion experience**.**
- With a 5.1 source program, it is possible to derive a good stereo downmix at the home's receiver. It allows the broad audience to be satisfied with the expected audio program quality, from the high-end home theater installations, televisions with integrated speakers and mobile devices. On the other hand, we cannot derive a 5.1 program from stereo mix with the same quality as if it was produced initially in 5.1. It is disappointing to have a surround listening environment and not be able to fully enjoy it because the content is stereo. Part of the audience finds themselves in the situation where they have access to a surround sound listening environment and cannot take full advantage of it because the content is stereo.
- Mixing with a better quality, such as 5.1 at 24-bit will allow future-proofing the content**,** where the audio program will sound better than stereo regardless of the listening environment.

If the producer is unable to provide a 5.1 multichannel audio mix for technical reasons, a program ranging from 2 tracks (stereo) up 6 tracks (5.1) will be accepted (ex: 3.0, Quad,…). This mix will need to be approved beforehand. Requirements for the two networks are different regarding program delivery. For each production, the following audio mixes shall be delivered:

ENGLISH SERVICES	**FRENCH** SERVICES
1. The **main program** mix, stereo (Lo/Ro) up to **5.1**	1. The **main program** mix, stereo (Lo/Ro) up to **5.1**
2. A **described video**, **stereo** signal (Lo/Ro)	2. A **described video**, **stereo** signal (Lo/Ro)
	3. A stereo mix (Lo/Ro), (monitoring and occasional on-air distribution)

At CBC/Radio-Canada the matrixed Lt/Rt Prologic Dolby surround is never used. Content providers shall be careful to always provide a simple stereo downmix, derived the following way from a 5.1 program:

Lo = L(0.0dB) + C(-3.0dB) + Ls(-3.0dB)

Ro = R(0.0dB) + C(-3.0dB) + Rs(-3.0dB)

In this document, the designation L/R always refers to a Lo/Ro downmix.

8.2 AUDIO FORMAT AND PROGRAM REFERENCE LEVEL

The audio format shall be compliant with the specifications listed below.

PARAMETER	SPECIFICATION
Format	Discrete audio, Linear **PCM**
Sampling	48kHz at all time
Resolution	24 bits
Transmittable Audio bandwidth	▪ 20Hz to 20kHz for all channels excluding the LFE channel. Exceptions may be made; examples include archive material or material gathered necessarily under adverse conditions. ▪ 20Hz to 120Hz for the LFE channel since it is band limited at the AC3 coding stage.
Program Reference Level:	-20dBFS, in compliance with SMPTE RP 155:2014.
Audio Channel Signal Correlation	Most receivers allow only a Lt/Rt downmix even if the metadata indicates 'Preferred downmix: Lo/Ro'. Consequently, the downmix is affected by the phase of the rear channels treated by the Lt/Rt downmix method. CBC/R-C has decided to set the parameter 'Surround Phase Shift' at Enabled to avoid any phase cancellation due to the Lt/Rt downmix. It is strongly recommended to listen to content in a simulated domestic environment (downmix Lt/Rt) using the metadata values listed in section 8.10.

8.3 LFE CHANNEL

- LFE (Low Frequency Effect) channel shall never be considered as bass management reinforcement as it is dropped for downmix.

- For 5.1 programs, the LFE channel audio content shall be different from those of the main channels and limited to effects at very low frequencies to avoid any phase or cancellation problems during playback by the consumer devices.

- The LFE channel content shall not be constant and shall not be the reproduction of the main channels with a 120Hz low-pass filter.

8.4 AUDIO CHANNEL ALLOCATION

Programs shall be identified using one of the following audio format labels: Multi-channel, Stereo, Mono.
The audio track allocation shall be:

HD and UHD Content

For CBC

TRACK NUMBER	1	2	3	4	5	6	7	8
Main Program	L	R	C	LFE	Ls	Rs	DV-L	DV-R
Stereo Program	Lo	Ro	U	U	U	U	DV-L	DV-R

For RADIO-CANADA

TRACK NUMBER	1	2	3	4	5	6	7	8	9	10
Main Program	L	R	C	LFE	Ls	Rs	DV-L	DV-R	Lo*	Ro*
Stereo Program	Lo	Ro	U	U	U	U	DV-L	DV-R	Lo*	Ro*

*always required

SD Content

TRACK NUMBER	1	2	3	4
Program	L	R	DV-L	DV-R

Where: U = Unused/Unassigned DV = Described Video

Lo/Ro = Stereo Signal, Left Only/ Right Only

Notes:

- Unused tracks shall be free of any signal.
- If no described video (DV) is available, a stereo program mix is required on the DV tracks 7 and 8 (HD and UHD content) or 3 and 4 (SD content).
- For French Services: At all times, a stereo version of the program is required on tracks 9 and 10. It is required for monitoring and occasional on-air distribution.

8.5 STEREO AND MONO PROGRAM COMPATIBILITY

When producing a 5.1 program mix, it is very important to monitor its stereo downmix version for compatibility. The stereo signal will be generated by using the metadata (downmix coefficients) shown in section 8.10 of this document. Please note that the LFE channel is not included in the downmix.

Mono compatibility of programs shall be guaranteed at all times.

8.6 USE OF UPMIX CONTENT

Any use of stereo mix sequences up-converted to a 5.1 mix in a program shall be pre-approved by CBC/Radio-Canada. These sequences shall be compatible with Lt/Rt downmix.

8.7 DESCRIBED VIDEO

The Described Video (DV) channels are a stereo mix derived from the main program to which descriptive commentary is added. The audio level of these channels shall be similar to the main program level and comply with the loudness specifications described in section 8.8.

If no described video is available, a stereo program mix is required on tracks 7 and 8.

8.8 PROGRAM LOUDNESS AND MAXIMUM TRUE PEAK

The audio signal measured using a broadcast loudness meter[1] having the ITU-R BS.1770-4 compliant algorithm shall meet the following criteria:

MEASURE	DESCRIPTION
Dialog Loudness	The dialogue loudness level measured on all channels at representative sections of anchor element (typically dialogue level) shall be -24LKFS +/- 2LU.
Integrated Loudness	The integrated loudness measured on all channels for the complete program duration should not exceed -24LKFS +/-2LU.
Maximum True Peak	A maximum True Peak level of -2dBTP for all channels.

Additionally, the measurement difference between the integrated loudness of the 5.1 mix and its downmix (and/or DV mix) should remain acceptable.

Note: Some elements have a direct impact on the loudness difference between a 5.1 mix and its downmix like the correlation between the centre channel and the left and right channels, the relative loudness of the rear channels versus the front channels, the use or not of some channels, etc.

[1] The ITU-R BS.1771-1 recommendation describes the loudness meter requirements.

8.9 SUBJECTIVE QUALITY

The audio program shall be produced with reproduction in a domestic environment in mind.

- The entire audio program shall be of superior quality, free of all noise and interference (buzz, hum, distortion, excessive sibilance).
- The entire audio program shall have an acceptable dynamic range. A compression rate sufficiently high to adversely affect the sound quality shall not be accepted. Additionally, the program shall not contain excessive dynamic excursions that could hamper listening comfort.
- The tone shall be natural and pleasant.
- Dialogue must remain intelligible throughout the entire audio program. No compromise shall be accepted.
- Audio-video synchronization shall be maintained throughout the program. The maximum tolerable misalignment of sound and picture shall be ± 16.6 ms (+ or - one field at 29.97 fps).

In addition to having to meet the criteria listed above, submitted programs shall be evaluated according to the five-point scale of the ITU-R BS.1284-2 standard as indicated in the following table:

RATING	IMPAIRMENTS	QUALITY
5	Imperceptible	Excellent
4	Perceptible but not annoying	Good
3	Slightly annoying	Fair
2	Annoying	Poor
1	Very annoying	Bad

Programs should meet the criteria for a 5 rating. The minimum acceptable quality for all program types shall be that of a 3 rating with rare exceptions, for example, in the case where program segments contain archival clips. This type of content shall be approved within the contractual agreement.

8.9.1 Audio Subjective quality and loudness range

The ATSC A/85 (Appendix E) document presents the results of a subjective experiment that concludes that the listener will accept loudness changes within +2.5 to -5.4dB of the target loudness. Outside this comfort zone the listener will be more susceptible to being annoyed and could ultimately reach for the remote.

Based on the conclusion of this study and considering the fact that any broadcasted program is viewed on a bloc basis, any program that exceeds +5 to -6 SHORT TERM LU[2] with reference to -24LKFS for a period of 3 seconds and more could be refused.

Additionally, program blocs will be measured individually and could be refused if they exceed the loudness standard (-22 to -26LKFS).

The subjective audio quality control is performed in an environment calibrated at 70dB SPL using a pink noise per channel. To maintain a tolerable loudness range intended for domestic listening it is highly recommended to maintain the loudness range (LRA)[3] of the program within 10LU.

[2] A loudness meter compliant with EBU R128 displays the short-term loudness using a 3 sec. time scale.
[3] A loudness meter compliant with EBU R128 displays the content loudness range i.e. 'the variation of loudness on a macroscopic timescale' (EBU Tech 3341-2016).

8.10 METADATA PARAMETERS ENCODED FOR ON-AIR BROADCAST

CBC/Radio-Canada operates in a static metadata environment, i.e. the metadata parameters are programmed directly in the AC3 audio encoder, at the transmission stage. The audio mix shall therefore be produced taking into account that the following metadata parameters will be applied at the audio coding stage.

Notes:

- The Dialnorm 'Dialog Level' parameter corresponds to the integrated loudness value of the program.
- The downmix coefficients (Center and Surround Levels) should be used to monitor the stereo mix compatibility with the 5.1 mix from which it is generated (quality, loudness, etc.).

PARAMETER	PROFILE 5.1 FOR MAIN PROGRAM	PROFILE 2.0 FOR DESCRIBED VIDEO
Dialog Level (dialnorm)	–24 LKFS	–24 LKFS
Channel Mode	3/2	2/0
LFE Channel	Enable	Disable
Bitstream Mode	Main Complete	Main Complete
Line Mode Profile	Film Light	Film Light
RF Mode Profile	Film Standard	Film Standard
RF Overmodulation Protection	Disable	Disable
Center Downmix Lev	0.707 (-3dB)	N /A
Surround Downmix Lev	0.707 (-3dB)	N /A
Dolby Surround Mode	Not Dolby Surround	Not Dolby Surround
Audio Prod Info	No	No
Mix Level	N /A	N /A
Room type	N /A	N /A
Copyright	Yes	Yes
Original Bitstream	Yes	Yes
Preferred Stereo Downmix	Lo/Ro preferred	N /A
Lt/Rt Center Downmix Level	N/A	N /A
Lt/Rt Surround Downmix Level	N/A	N /A
Lo/Ro Center Downmix Level	0.707 (-3dB)	N /A
Lo/Ro Surround Downmix Level	0.707 (-3dB)	N /A
Dolby Surround EX Mode	Not Surround EX	N /A
A/D Converter type	Standard	Standard
DC Filter	Enable	Enable
Lowpass Filter	Enable	Enable
LFE Lowpass Filter	Enable	N /A
Surround 3 dB Attenuation	Disable	N /A
Surround Phase Shift	Enable	N /A

9 Time Code

The timecode shall be:

- Present and continuous from the beginning of the leader up to the end of the trailer;
- Have the value 10:00:00:00 (hh:mm:ss:ff) at the first frame of the program;
- Use the same frame rate as the content original frame rate. For a frame rate of 29.97fps, use the 'drop frame' mode to ensure that the timecode remains synchronous with real time. It is important to pay particular attention to drop frame when a program is transferred from 23.98 or 24 frames/seconds (fps) to 29.97 fps.

Note: In order to move between the nominal 23.976 and 29.97 formats in a unique way, it is recommended that the video frames of the 23.976 fps material with the timecode frame number zero be converted to an A frame, as described in SMPTE ST 12-1:2014. In addition, the SMPTE ST 318:2015 recommends that these A frames be aligned with the field identified by the Field 1 pulse of the 10 fields sequence described in this SMPTE standard document.

10 Metadata

The program delivery file package shall include a file containing descriptive information (metadata) about the program. This information is used for media asset management and by editing systems. In the near future, CBC/Radio-Canada will provide a web interface for distributors to enter all metadata parameters. With this new tool, the metadata file will be generated automatically.

In the meantime, distributors shall enter the content metadata in an XML file. This data file shall have an .xml extension and comply with XML 1.0 Specification produced by the World Wide Web Consortium (W3C). The XML file shall contain the slate information described in section 7.3.

Both program and metadata files shall have the same name. An XML file example is given in section 12 - Annex.

11 SD - Standard Definition (SD) Video Essence

CBC/Radio-Canada will accept native Standard Definition (SD) content delivery in special cases; for example, legacy content or archival material. This type of content shall be approved within the contractual agreement. SD content delivered to CBC/Radio-Canada shall be compliant with the specifications listed below.

GENERAL SPECIFICATIONS	
Video	720x486 NTSC or 720x576 PAL (4:3 or Anamorphic 16:9 SD)
	4:2:2 with 8/10-bit quantizing,
	Color Space in conformance with Rec. ITU-R BT.601
Frame Rate/ Scan Type	▪ Content shall be delivered with its **original frame rate** and scan type. ▪ The frame rate shall remain constant from the beginning of the leader up to the end of the trailer. ▪ Interlaced scan shall be upper field first ▪ Accepted frame rates and scan types: 29.97i (In-house standard), 23.976p, 25i, 25p, 29.97p.
Safe Action Zone	93% height and width of the full SD picture (per SMPTE ST 2046-1:2009)
Safe Title Zone	90% height and width of the full SD picture (per ST 2046-1:2009)
Program Structure	See section 7.3
Closed Captions	- Provide a separate .scc file - Cc provided on line 21 will also be accepted
Audio	PCM, 48kHz, 24bits resolution (except for tapes, provide the best resolution available)
	▪ Track Allocation 1:L 2:R 3:DV-L 4:DV-R
	See Section 8 for the general audio specifications.
Described Video	If no DV is available, a stereo mix of the program is required on tracks 3 and 4.
Lip Sync	1 field maximum tolerable sound and picture misalignment
Time Code	▪ Present, continuous (from start to end), for 29.97fps use the 'drop frame' mode. ▪ See Section 9 for the general Time Code specifications.
Credits	See section 5

11.1 ACTIVE FORMAT DESCRIPTION (AFD)

For any up-converted legacy 4:3 aspect ratio materials distributed through a TV channel to viewers equipped with 4:3 or 16:9 aspect ratio receivers, CBC\R-C inserts the following Active Format Description (AFD) values, as described in SMPTE ST 2016-1:2009, to be carried with each program to the TV receiver. The receiver will automatically choose the right display format for each material and ensure an optimum content display.

The program display format presented on 4:3 TV receivers differs between the two networks:

- **CBC** inserts the AFD value in the program file such that the legacy 4:3 receivers will automatically select the letterbox display.
- **Radio-Canada** inserts the AFD values in the programs files such that the legacy 4:3 receivers will automatically select the letterbox display for original HD content and present a full screen 4:3 display for original SD content.

Reminder for Digital Exclusives: Specifications differ for this element (see section 13 for details).

12 Annex - XML File Submission Example

Values indicated in the file below are examples. They shall always meet specifications described in this document. The file example below indicates the audio track allocation required for a content submitted to the English Services. Please refer to section 8.4 for additional details on the audio track allocation.

Note: Letters with accents such as é, è, ë, ö etc. must not be used.

```
<?xml version="1.0" encoding="utf-8" ?>
<SLATE_DATA>
<Program_Network>Network</Program_Network >
<Program_type>Show type</Program_type>
<Program_title>Show name</Program_title>
<Series_name>xxxx</Series_name>
<Episode_title>title</Episode_title>
<Episode_season_number>season</Episode_season_number>
<Episode_number>number</Episode_number>
<Producer_name>name</Producer_name>
<Producer_contact>contact</Producer_contact>
<!-- Program length in H:M:S-->
<Program_length>00:00:00</Program_length>
<!-- Main program audio type (stereo, multichannel)-->
<Main_program_audio_type>multichannel</Main_program_audio_type>
<!-- Audio track allocation (including DV)-->
<Audio_track_allocation>
      <Audio_track_1>L</Audio_track_1>
      <Audio_track_2>R</Audio_track_2>
      <Audio_track_3>C</Audio_track_3>
      <Audio_track_4>LFE</Audio_track_4>
      <Audio_track_5>LS</Audio_track_5>
      <Audio_track_6>RS</Audio_track_6>
      <Audio_track_7>DV</Audio_track_7>
      <Audio_track_8>DV</Audio_track_8>
</Audio_track_allocation>
<!--Closed Captions presence (Yes, No)-->
<Closed_Captions>Yes</Closed_Captions>
<Segment_1_Time_Code>00:00:00:00</Segment_1_Time_Code>
<Segment_2_Time_Code>00:00:00:00</Segment_2_Time_Code>
<Segment_3_Time_Code>00:00:00:00</Segment_3_Time_Code>
<!-- Original aspect ratio (4:3 or 16:9)-->
<Original_aspect_ratio>4:3</Original_aspect_ratio>
<!-- Integrated loudness value (-26 to -22 LKFS)-->
<Integrated_loudness_value>-24</Integrated_loudness_value>
<!-- Described video (Yes, No)-->
<Described_video>Yes</Described_video>
</SLATE_DATA>
```

Both program and metadata files shall have the same name, as indicated in the example below.

DESCRIPTION	EXAMPLE	NOTE
Video/Audio File	CBC_SERIES_TheShowXYZ_S02_E04.mxf	For CBC, 'The Show XYZ', Season 2, Episode 4 [Pgm/Series Title]_ [Season#]_ [Episode#]
Metadata File	CBC_SERIES_TheShowXYZ_S02_E04.mxf	

13 Digital Exclusives - Specific Requirements

The contractual agreement may specify that the content is a Web Exclusive, i.e. the video or audio file is intended to be presented only on CBC/R-C's Web portal. These requirements exclude Gem and Tou.tv. The file delivery requirements for Web exclusives differ slightly from those for general content acquisition.

Digital Exclusives - Audio/Video Files (Does not include Gem or tou.tv)

The content shall comply with specifications listed in sections 2 to 12 except for the elements listed below.

PARAMETER	SPECIFICATION
4:3 content and Social Media content - Image Display	All 4:3 content and the formats used for social Media content (4x5, 1x1, 2x3, 9x16, etc.) must be **pillarboxed** into a 16:9 frame.
Video Format	HD and UHD content only
Audio Track Allocation	Stereo program: **1:L 2:R** 3:u 4:u 5:u 6:u **7:DV-L 8:DV-R** 5.1 programs: 1:L 2:R 3:C 4:LFE 5:Ls 6:Rs 7:DV-L 8:DV-R Provide DV when available u = unused
Closed caption	Closed caption must be embedded in the mxf wrapper in order to be processed. No sidecar CC file accepted for Digital Exclusives.
Program Segment	One program segment per file

The video/audio file shall have the following structure:

TIME CODE (at start)	DURATION (seconds)	AUDIO	VIDEO
00:00:00:00	----	Program	Program
----	1	Silence	Black

Audio excerpts, podcasts or audiobooks - Audio only Files

AUDIO ONLY CONTENT	
Audio	24bits, 48kHz, stereo (1:L 2:R) Integrated Program loudness: -24LKFS +/-2LU, -10dBTP max.
Structure du Fichier	No silence (leader), program, no silence (trailer)
Format de fichier	Uncompressed linear PCM (.wav), preferred