Introduction

This document describes in detail all the technical and quality aspects required for any programme either produced in the Czech Television or delivered there within the framework of any sort of contractual relationship. This document also determines binding duties of production staff regarding technical means used by them.

The quality assessment being very subjective depends on the programme nature. Some quality requirements that cannot be expressed by means of exactly measurable parameters are being expressed in a relative way (suitable / adequate, not suitable etc.) and it will be always assessed and judged whether the quality expectations of any future spectator would be met and whether the result is adequate to the means spent.

Wherever in the following text it is stated „after an previous agreement“ or „must be discussed in advance“, it means that the use of any described way of shooting, technique or way of processing has to be discussed on the technological preparatory meeting before starting the project and this fact should be stated in the appropriate minutes. In case there is no such explicit statement in the minutes or the preparatory meeting does not take place (sufficiently in advance before the project realization so that according to the final conclusions from this meeting there should still remain the possibility to modify any proposed way of shooting, technique or way of processing), the use of such way is not acceptable.

Video

Formats

UHD

Material may be delivered for further processing after previous agreement.
Material must be made, undergo postproduction and delivered according further specification:

- Raster 3840 x 2160 pixels with the aspect ratio 16 : 9
- 50 or 25 frames per second, progressive
- Colour system Y Cr Cb
- Sampling 4 : 2 : 2 or 4 : 2 : 0
- Colour space according ITU-R BT.2100

The use of concrete parameters of dynamic range as described in ITU-R BT.2100must be discussed in advance.

HD

Material must be made, undergo postproduction and delivered according further specification:

- Raster 1920 x 1080 pixels with the aspect ratio 16 : 9
- 25 frames (50 fields) per second interlaced (1080i/25), odd field first [1](EBU system S2)
- Sampling 4 : 2 : 2
- Colour space according ITU-R BT.709
- This format is completely specified in ITU-R BT.709

SD

Material may be delivered for further processing only after previous agreement.
Material must be made and delivered according further specification:

- Raster 720 x 576 pixels with the aspect ratio 16 : 9 or 4 : 3
- 25 frames (50 fields) per second interlaced (576i/25), odd field first
- Sampling 4 : 2 : 2
- Colour space according ITU-R BT.601
- This format is completely specified in ITU-R BT.601.

Signal parameters

Video signal must make optimal use of the whole accessible dynamic range (RGB). If the signal is processed in the YUV form, there might „illegal“ combinations come into being, which after back conversion would create signal exceeding permitted range. In such a case it is necessary to continuously check signal not exceeding permitted limits.

In practical conditions it is sometimes difficult to avoid generating signals slightly out of range and it is taken as reasonable to accept a small tolerance:

- RGB components and the respective luminance signal (Y) should not usually exceed the range of digital samples „Working range“ in the following table,
- The measuring equipment should indicate the exceeding of the range as „Out-of-Gamut“ only after the error is greater than 1% of an integrated part of the active frame.

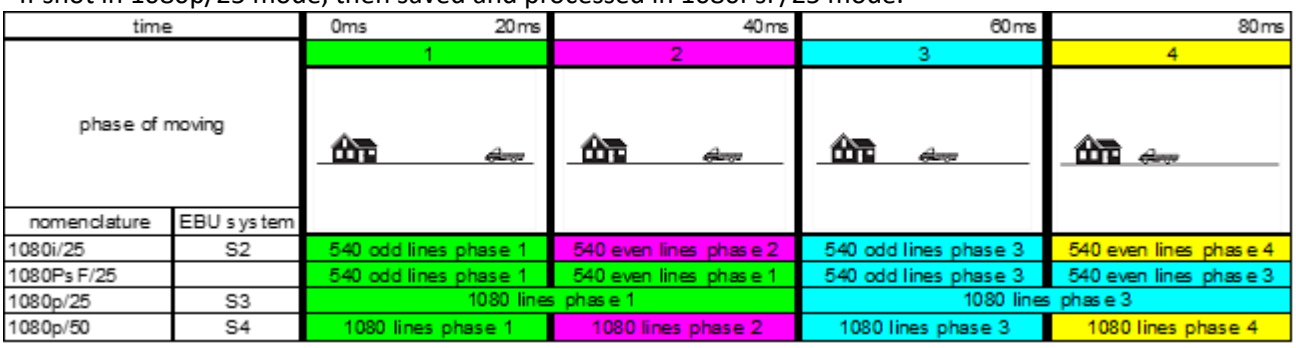
Further details are to be found in the recommendation EBU R103.

Table 1 - Videosignal (digital samples) level ranges

Bit depth	Working range	The highest acceptable range	The highest transmittable range
8 bit (SD only)	16 – 235	5 – 246	1 - 254
10 bit	64 – 940	20 – 984	4 - 1019

All signals out of „Working range“ are described as „error gamut“. The signals cannot exceed „The highest transmittable range“ and therefore (should such signals occur) these parts will be clipped of.

[1] If shot in 1080p/25 mode, then saved and processed in 1080PsF/25 mode.



Finalized programmes must not contain video levels exceeding „Working range“.

Colour „legalizers“ should be used with great care, because they might cause artifacts in picture which are more disturbing than range errors that they try to correct. It is to recommend **not** to „legalize“ video signals before all video processing is finished.

Picture must not contain any subjective visible errors such as noise, picture out of focus, instability, digital artifacts, geometrical distortion, incorrect colour rendering, vignetter effects, object-lens dirt etc. and the video signal has to make the best use of the whole dynamic range.

HDR

In the Czech Television video signals with the extended dynamic range cannot be processed. As exception might be the acquisition of demanding dramatic production projects, where the concrete processing technology must be discussed in advance.

Acquisition

Camera

To assess the cameras suitability the recommendation EBU R118 is used. Cameras must always fulfil at least the requirements of the „HD Tier 2L“, for the more demanding dramatic production projects the requirements of the „HD Tier 1“.

DSLR

DSLR cameras are acceptable only for shooting in the regime „time lapse“, for the production of animated films or after the previous agreement regarding shooting in dangerous places or as a hidden camera.

After previous discussion these cameras might be used for student or low-budget projects without any ambition to become an archive item of permanent value.

Drones and remote controlled cameras

Photographic as well as television cameras attached to these equipments must fulfil the requirements of the EBU R118, unless there is an exception out of this rule discussed in advance.

In case the drone or the remote equipment have not the sufficient picture stabilizer it is recommended that the picture pick up element be of higher resolution than necessary to enable electronic stabilisation during the postproduction.

The producer must ensure that drones and other remote controlled cameras if used in the Czech Republic territory are driven by trained pilots only who have a valid authorization to make shootings for commercial use and who must observe valid legal standards and rulings regarding the use of the respective equipment type. When shooting abroad it is always necessary to make oneself familiar in advance with the local valid regulations.

Cinematographical film

As acquisition format the 35mm negative film is accepted (2 or 3 perf.) with sensitivity 250 ASA or lower.

Postproduction

Programme projects must be set for use in the interlaced (PsF) regime. Electronically generated moving effects, graphics, moving subtitles etc. must be even in case of the PsF material generated as interlaced and as such inserted to the project to prevent an unacceptable stroboscopic effects.

Codecs

During the postproduction it is necessary to minimize the number of data conversions (codec change). If the material shot cannot be processed directly, it is desirable to either change it just before the processing to the format of finalization or, after an earlier discussion, use an „off-line" method with „low-res" material.

Frame rate conversion

To avoid picture quality degradation the frame rate conversion equipment should use motion prediction and movement compensation system (motion vector conversion).

The preferred way of 24fps film (including 23,976 fps) to 25 fps conversion is to change the velocity and therefore a great care must be paid to handling the sound track.

Preferred conversion methods:

- 24 fps and 24/1.001 fps to 25 fps – velocity change
- 24 fps and 24/1.001 fps to 50 fps – velocity change and frame doubling
- 30 fps and 30/1.001 fps to 25 fps – motion compensated conversion
- 30 fps and 30/1.001 fps to 50 fps – motion compensated conversion
- 60 fps and 60/1.001 fps to 25 fps – not recommended[2]
- 60 fps and 60/1.001 fps to 50 fps – motion compensated conversion

Aspect ratio

The screen 16 : 9 has to be filled with the video information in both directions without any geometrical distortion.

Following exceptions can be allowed after previous agreement:

Cinemascope

Films with the aspect ratio 2,39:1, 2,35:1, 1,85:1 must be placed in the centre of the active picture 16:9 without any geometrical distortion with the full picture format filled up by black stripes (letterbox).

Standard cinema

Films and programmes shot in the formats 1,37:1 or 4:3 must be placed in the centre of the active picture 16:9 without any geometrical distortion with the full picture format filled up by black stripes (pillarbox).

Archive materials

Archive materials including the up-converted ones must comply with all the technical requirements stated in this document, if relevant.

Archive material has to be taken from the best possible and accessible source and before its use it must be adequately restored (cleaning, colour and exposition correction, drop-out and sound correction ...).

Up-converted SD materials

UP conversion of SD materials requires special attention and only up-converters of the highest quality may be used in order to maintain the best possible picture quality. In general holds true, that the picture with standard definition and up-converted to HD may not be worse than the origin, provided the conversion was done correctly. Because of this it is not recommended to use conversion with customary editing software.

[2] Conversion 60 fps >> 25 fps interlaced is not recommended, but under certain circumstances it can be accepted (if motion compensated). Conversion 60 fps >> 25 fps progressive is inadmissible

The active part of the SD starts and stops between the fields by a half-line. During the conversion this part must be removed to prevent picture flickering.

For the up-conversion only the active part of the picture may be used, all signals contained in the vertical blanking interval (VITC, switching and measurement signals ...) must be removed.

Aspect ratio

Archive material not being in the 16:9 format must fulfil following conditons:

- aspect ratio may be between 4:3 and 16:9, but must have a stable width among all sequences.
- material must be centrally placed in the frame 16:9, unless supplemented with graphical items
- no geometrical distortion
- sharp and clean edges (ie any artefacts on edges or dirt from the film window must be removed)
- all parts outside the active picture area must be black, unless supplemented with graphical items

Safe area

Any subtitles or text on the screen already contained in the archive material should be preserved, if possible, in the safe subtitle area.

Use of materials with lower definition

The length of the material with definition lower than the original definition of the programme must not exceed 25% of the whole length of the programme. The material with lower definition must not create long continuous sequences and it has to be suitably stylized in a creative way so as not to degrade the tune of the whole programme. An exception from this rule must be made in a reasonable and purposeful way from the dramaturgical point of view and must be discussed in advance.

As low resolution materials are considered following formats:

- HDV from all producers
- all codecs with bit streams under levels stated in EBU R118 for HD Tier 2L
- cameras not meeting requirements EBU R118 for HD Tier 2L
- material generated or processed on the 720 line equipment
- film not meeting the standard required (16 mm and worse)

3D

In the Czech Television the 3D materials cannot be processed.

Screen text safe area

All the text on the screen must be clear and readable and must be placed in given safe areas. All text sizes must be readable after the conversion into SD. The Czech Television may consider to take some programmes out of this rule, eg some feature films thought primarily for cinemas.

Text dimension

The minimum height of the text is 40 lines (in HD resolution). This minimal height takes into account the requirement for text legibility with minimum 20 lines height after the conversion into SD.

Subtitles

Subtitles are accepted in the STL format as in the document EBU Tech.3264 and according to this in so created file of STL type. The use of other subtitle file formats must be agreed in advance and this format must always be suited to be processed in the programme FAB Subtitler Professional 7.

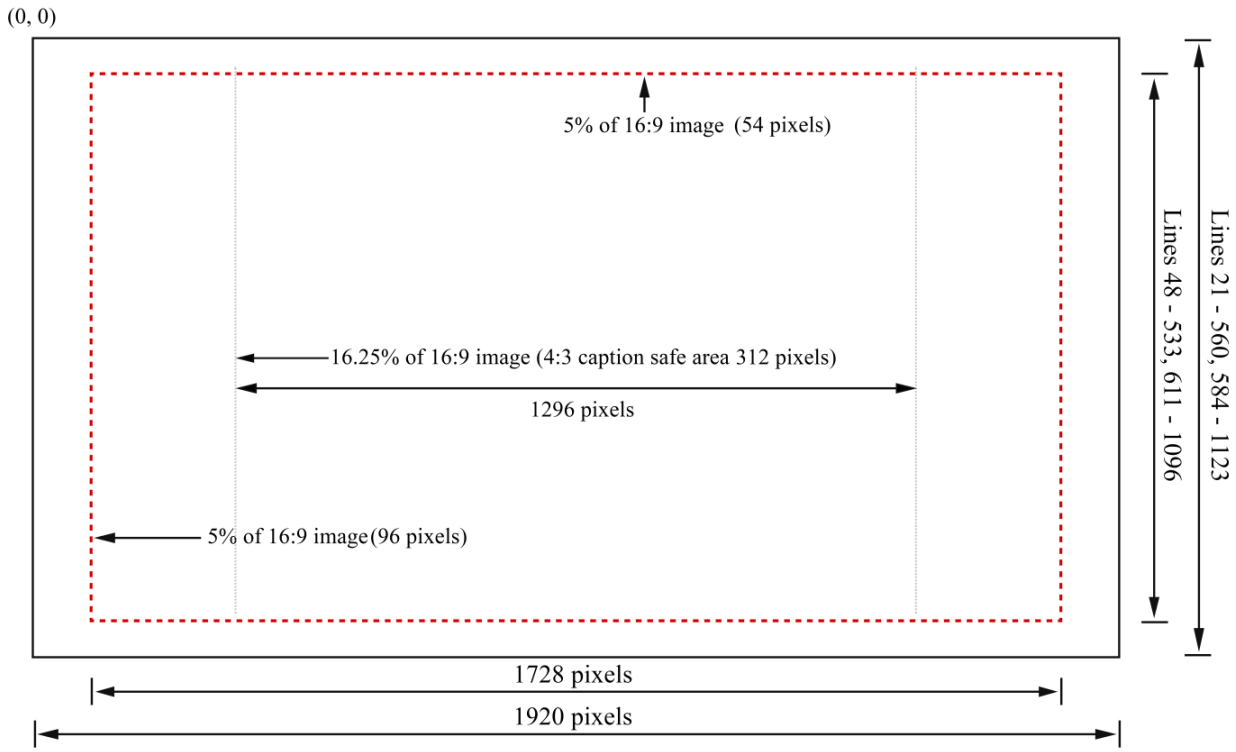
Dialog subtitles must not contain any spelling and grammatical errors and must be correctly timed to allow comfortable reading. Subtitles must also be clearly visible for all the time. When placed over the part of the

screen with the same colour as the subtitles, the outline or shading (or both) must be used and the subtitle form chosen should be kept for all the length of the programme.

Table 2 - Safe area HD dimensions

Picture format	Safe area dimensions (%)	Safe area dimensions (pix)
16:9	90% of picture width 90% of picture height	96 - 1823 54 – 1025
4:3	67,5% of picture width 90% of picture height	312 - 1607 54 - 1025

Picture 1



Audio

Dramaturgy

Television studios receive many complaints regarding unintelligible dialogues. It is important to realize, that the viewer neither had seen the programme before its transmission nor he had read the script. It is the producer who is responsible to secure easy understandability for the viewers.

In order to challenge justified and repeated complaints of the viewers, the Czech Television will in future take as suited for further processing or for transmitting only programmes observing in their final version all rules stated below.

Audio accompaniment in its final form should contain balanced ratio of spoken speech, music and of other sound components and should not contain any disturbing components such as noise, hum, tone pitch fluctuation, distortion and any other artefacts of the coding process. Audio content must correlate with the picture and there should not be any passages that due to the missing or on the contrary excessive sound elements are in discrepancy with the picture.

It is necessary to minimize the number of sound planes used in the television programme and to take the dialogue and the commentary as a dominant part. The proportion of the other components should not mask the speech.

Combination of the music background and dialogue or commentary may be used in television programmes only in case of artistic or dramaturgical reasons. But even in this case when the sound background is necessary, following rules must be observed:

- if combined with speech, use only low level of music
- take into account the quality of the dialogue if connected with sound background
- avoid vocal and too dynamic music as a background sound
- take into account that some types of solo instruments are not in some interpretations suitable as background to the spoken word (piano, trumpet, percussion instruments)

For programmes oriented on seniors the sound should be compiled particularly with feeling because the problem of decreased understandability is increasing from circa fifty years of a viewer´s age.

The understandability of programmes with multichannel sound has to be verified in lower format regimes (stereo, mono).

Conflicting cases of maintaining understandability should be always assessed on a small audio monitor in MONO format. The producer of television programmes for the CzechTelevision should keep this aspect in mind and perform this check during sound compilation.

Volume

All programmes must be compiled so as to meet the requirements of EBU R128.

Valid permissible parameters as measured in the whole length of the programme are: Programme Loudness -23.0+/-1.0 LUFS, Loudness Range < 18 LU, Maximum True Peak Level < -3.0 dBTP. Adherence to the required parameters is independent on the sound format used (STEREO or MCH) and supposes the use of the Relative Gate -10 LU.

To finalize the sound track we recommend to keep to the recommendations as described in the "BEST PRACTICE GUIDE SOUND MIXING FOR BBC PROGRAMMES**".**

Measurement

Indicators must meet the specifications in EBU Tech 3341. Programmes must be measured in the mode EBU Integrated (I), this measurement must be applied to the whole length of the programme (EBU Tech 3343).

Signal parameters

The audio signal must be digitalized in compliance with the recommendation EBU R85 ie sampling frequency 48 kHz, bit depth 24 bits. In the whole production the signal must be processed and mapped into the file in a not compressed form.

Timing - lip sync

In the whole material the time difference between picture and sound must not be subjectively noticeable and as in the recommendation EBU R37 must not exceed 40 ms in case the sound is fast and 60 ms when the sound is lagging behind the picture.

MONO audio

MONO audio must be recorded in the stereo track as dual MONO so as to make it possible to be processed and delivered in a STEREO channel. The two identical MONO signals in both tracks must not show a level difference greater than 1 dB and a phase difference of 15 degree / 10 kHz.

STEREO audio

In the Czech Television the STEREO regime is the basic way of processing and delivering the audio signal as an audio component of the whole programme. The programme itself must contain a correct separate STEREO audio track even in the case that the programme is equipped with the SURROUND sound.

Because of the necessary compatibility of the STEREO programmes with the MONO signal, the phase difference between the channels must not in the longer time interval exceed 90° in the whole range.

SURROUND sound

The SURROUND sound is accepted in the format 5.1+2 with the channels fanned out according the ITU R-BR 1384 in the succession L – R – C – LFE – Ls – Rs – Lo –Ro.

The SURROUND sound must be compiled with small dynamics suitable for listening in households. It is not acceptable to use the cinema distribution soundtrack. Even if technically there is always distributed the signal 5.1, it is preferred the TV mix to be in the format 5.0, ie "LFE MUTE".

Disabled Support

The support of disabled is based on delivery of supplementary files that must contain:

Subtitles

The format of hidden subtitles prepared for the transmission must meet the standard EBU Tech 3264-E.

The address and the format of hidden subtitle file content must correspond to the delivered programme essence without any need to further intervention into its content.

The source files for the production of hidden subtitles in the Czech Television premises must be in the format accepted by the programme "FAB Subtitler 7 Standard", as a structured text in the format "plain text" or Word 97-2003 with the lines ended by the signs CR/LF and coded in the language WIN CP 1250 or Unicode UTF-8.

Audio description

The sound track of the audio description is accepted in the AD form only, ie not the complete mix, but as content a commentary of the audio description. The time link to the programme essence is direct, without any use of offset. The information about assigning to the address of the first frame that has to be really transmitted from the broadcasting copy (ie not the address of the audio modulation start) must be inserted into the metadata QLTY-chunk part of the file.The BWF file must be always produced with the audio signal coding PCM MONO 48 kHz/24bit, which is the condition sine qua non for the following synchronisation according to the stated time stamp in the header.

File format

Table 3

Data files format for the programme broadcasting in the Czech Television

name	container	data frequency [Mbit/s]	picture						sound			
			codec	number of bits	color sampling	dimensions [pixel]	frane frequency[Hz]	interlaced/ progressive	number of tracks	codec	sampling[kHz]	number of bits
HD MPEG 422 Long-GOP	MXF OP1a	50	MPEG-2 422P@HL	8	4:2:2	1920 x 1080	25	interlaced	8	PCM	48	24
HD MPEG 420 Long-GOP	MXF OP1a	50	MPEG-2 MP@HL	8	4:2:0	1920 x 1080	25	interlaced	8	PCM	48	24
HD MPEG 422 I-Frame	MXF OP1a	100	MPEG-2 422P@HL	8	4:2:2	1920 x 1080	25	interlaced	8	PCM	48	24
	In yellow	is marked the format preferred for recording in the premises of the broadcasting technology										

In case of international exchange (possibility of further postproduction processing in the Czech Television) following formats are acceptable:

Table 4

Czech TV Technical Specifications							
1	*File Container*	MXF	QT	QT	QT / MXF	QT / MXF	MXF
2	*Video Codec*	XDCam HD 422	ProRes 422	ProRes 422HQ	DNxHD 185	DNxHD 185X	XAVC-I HD
3	*Video Bitrate*	50 Mb/s	122Mb/s	184 Mb/s	184 Mb/s	184 Mb/s	100 Mb/s
4	*CBR/VBR*	CBR	VBR	VBR	CBR	CBR	CBR
5	*Frame Rate*	25	25	25	25	25	25
6	*Aspect Ratio*	16:9	16:9	16:9	16:9	16:9	16:9
7	*Resolution*	1920x1080	1920x1080	1920x1080	1920x1080	1920x1080	1920x1080
8	*Color Sampling*	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2
9	*Interlaced / Progressive*	Same as Source	Same as Source	Same as Source	Same as Source	Same as Source	Same as Source
11	*Audio Codec*	PCM	PCM	PCM	PCM	PCM	PCM
12	*Audio Channels*	4 (2 x stereo)	4 (2 x stereo)	4 (2 x stereo)	4 (2 x stereo)	4 (2 x stereo)	4 (2 x stereo)
13	*Sample Frequency*	48 kHz	48 kHz	48 kHz	48 kHz	48 kHz	48 kHz
14	*Audio Bit Depth*	24	24	24	24	24	24
15	*Audio Channels 1,2*	Original Mix	Original Mix	Original Mix	Original Mix	Original Mix	Original Mix
16	*Audio Channels 3,4*	M&E	M&E	M&E	M&E	M&E	M&E
17	*Color Bars / Test Tone*	NO	NO	NO	NO	NO	NO
18	*Time Code Start*	10:00:00:00	10:00:00:00	10:00:00:00	10:00:00:00	10:00:00:00	10:00:00:00

File names

File names must definitely identify particular material and must not contain any signs with diacritics. For the file names it is permissible to use only capital and small letters of English alphabet, numerals and signs . (dot) and _(underline) ie signs (in decade way) 48 – 57, 65 – 90 and 95 – 122 of the basis ASCII table.

Table 5 **- Programme modes and audio tracks assignment for finalized programmes**

Highest nr. of tracks	Type of recording	Notes	Number of the track											
			1	2	3	4	5	6	7	8	9	10	11	12
4	Stereo	5	Czech mix L	R	International L	R								
	Stereo	1,5	Original mix L	R	International L	R								
	Dual stereo	5	Czech mix L	R	Original mix L	R								
	Surround	6	Czech mix L	R	Czech mix Dolby E									
	Surround	6	International L	R	International Dolby E									
8	Stereo	2,5	Czech mix L	R	International L	R								
	Stereo	1,5	Original mix L	R	International L	R								
	Dual stereo	1,5	Czech mix L	R	Original mix L	R								
	Surround	6	Czech mix L	R	Czech mix Dolby E		International L	R	International Dolby E					
	Surround	4,6	Original mix L	R	Original mix Dolby E		International L	R	International Dolby E					
	Dual Surround	3,6	Czech mix L	R	Czech mix Dolby E		Original mix L	R	Original mix Dolby E					
	Surround	2	Czech mix L	R	Czech mix L	R	C	LFE	Ls	Rs				
12	Stereo	2,5	Czech mix L	R	International L	R								
	Stereo	1,5	Original mix L	R	International L	R								
	Dual stereo	5	Czech mix L	R	Original mix L	R								
	Surround	6	Czech mix L	R	Czech mix Dolby E		International L	R	International Dolby E					
	Surround	4,6	Original mix L	R	Original mix Dolby E		International L	R	International Dolby E					
	Dual Surround	3,6	Czech mix L	R	Czech mix Dolby E		Original mix L	R	Original mix Dolby E		International L	R	International Dolby E	
	Surround	2	Czech mix L	R	Czech mix L	R	C	LFE	Ls	Rs				

Yellow marked signals may be transmitted, the other may be used only for further postproduction processing.

Notes:

1 Transmittable track 1,2 in case of programme with Czech captions and transmitted with original audio.
2 Transmittable only stereo from the track1,2.
3 Dual mot transmittable - canbe transmitted only in one language version from the track 1-4.
4 Transmittable track 1,2,3,4 in case of the programme with Czech captions transmitted in original audio.
5 May be mono signal as well. This mono must be recorded always in both track of the pair in question with identical amplitude and phase.
6 Dolby-E stream must conform with folloving specification:
- AES 3 stream must be marked as non-audio according to SMPTE 337M.
- Preferred format: 5.1+2; 25fps; 20bit

Time code

The Timecode value of the first frame in the programme must be set in MXF Material package timecode, in MXF Source package timecode and in individual video and audio tracks. This timecode value must for all items mentioned above be identical, continuous and with the same length and framerate. VITC (possibly DVITC) must not be present.

Metadata

The material delivered must contain a set of necessary data, so called mandatory metadata.

These are:

- The name of the organisation that produced the programme
- Programme copyright and the year of production
- The name of the programme (including number of the episode, subtitle)
- Start of the programme (Timecode value)
- End of the programme (Timecode value)
- Picture standard and format
- Colour status
- Sound tracks assignment
- IDEC
- Audio format

Form of metadata delivered:

- Text file assigned to the programme essence as a file or a stream by the means of suitable identification (in case the used data container does not enable direct metadata loading)
- If the data file is delivered on a physical medium, then both the medium and its cover (if its nature allows for it) must be provided with identically marked labels. As inseparable part of this is also “The list of video recordings”, where there are all metadata in a “paper” form. Should the medium and its cover be clearly identified by a signature, no other description on a medium label is required.

Configuration of recorded programmes

Programmes delivered in the file form must contain only the programme essence (the file begins with the first frame and ends with the last programme frame).

Programmes delivered on the XDCam medium must be structured as stated in the table 6.

Table 6

Clips Structure and determination of start addresses for XDCam				
XD CAM - The whole programme stored on one carrier (medium) or the first part of the programme				
MXF clip	IN	OUT	DUR	the content of the clip
C0001	09:59:00:00	09:59:29:24	00:00:30:00	test bars
C0002	09:59:30:00	09:59:59:24	00:00:30:00	black
C0003	10:00:00:00	10:59:16:24	00:57:17:00	programme
C0004	10:59:17:00	10:59:46:24	00:00:30:00	black - The end - 30 sec.
XD CAM - the second part of the programme				
MXF clip	IN	OUT	DUR	the content of the clip
C0001	19:59:00:00	19:59:29:24	00:00:30:00	test bars
C0002	19:59:30:00	19:59:59:24	00:00:30:00	black
C0003	20:00:00:00	20:59:16:24	00:57:17:00	programme
C0004	20:59:17:00	20:59:46:24	00:00:30:00	black - The end - 30 sec.
XD CAM with several programmes stored on one carrier (medium)				
MXF clip	IN	OUT	DUR	the content of the clip
C0001	09:59:00:00	09:59:29:24	00:00:30:00	test bars
C0002	09:59:30:00	09:59:59:24	00:00:30:00	black
C0003	10:00:00:00	10:21:59:24	00:20:00:00	programme 1
C0004	10:22:00:00	10:22:59:24	00:01:30:00	The black signal between programmes must be in the minimal duration of 20 sec
C0005	10:23:00:00	10:42:59:24	00:20:00:00	The second programme must start from the integer minute
C0006	10:43:00:00	10:43:29:24	00:00:30:00	black - The end - 30 sec.

Programmes for duplicating and archiving

For programmes supposed to become an archive item of lasting value it is necessary to make a backup file or a backup medium usually in the highest possible quality as a backup copy for the future use. Concrete technical parameters of this material must be discussed on the technical take over meeting and then fully observed.

Quality check

To maintain the technical production standards demanded by the Czech Television and to gain information about the quality when taking over programmes delivered, there is a quality check divided into three steps. In each step there is an array of tests based on the recommendation AS – 11 DPP (Digital Production Partnership) for the international programme exchange.

File format check

This check is done by an automatic QC equipment (“analyzer”). All the programmes checked **must comply** with the tests stated in the table 7 in this document.

Programme content check by the automatic quality check system (QC)

Array of tests based on the recommendation DPP with references to the recommendation EBU is stated in the table 8. As a result of each test there is a statement whether the test criteria were met or not. A

summary information about the pass or failure in the test including the value of the time code of every error is put down in the QC protocol.

The tests are divided into the ones, where the fulfilment is obligatory, and the others with only technical warnings as well as editorial reminders.

- **Obligatory:**

If there is a failure in the **obligatory** test, the error in question **must be corrected** by the supplier of the programme or possibly after an agreement also in the postproduction of the Czech Television.

- **Technical warning:**

In case of the tests the failure of which results in technical warning there should be a check of the erroneous address and this should be repaired if possible. These problems may have technical reasons, which might be corrected. Should the correction be impossible or should it be a part of any intentional video or audio effect, the Time Code value of this or those addresses must be made note of to the QC protocol.

- **Editorial reminder**

These reminders refer to the problems that when viewing the programme in question might not be acceptable by the viewer, nevertheless in some cases these problems might be unavoidable. Reminders should therefore be checked and if decided to accept them without any correction the Time Code value of this address must be made note of to the QC protocol.

Programme check by trained personnel on the technical workplace

The programme check workplace must be equipped with suitable video and audio monitors as well as with measurement equipment. This check results in an assessment whether the programme meets all the quality requirements or whether in the protocol there is stated any reason of failure. In an overview of all tests in the table 9 there it is stated, whether fulfilment of the test is obligatory or whether there will be only technical or editorial reminders.

- **Obligatory test fulfilment:**

In case of failure in any check (test) stated as obligatory it is necessary to have the errors repaired before taking over the programme.

- **Technical warnings:**

Technical warnings regard generally technical problems that the automatic quality check system QC does not recognize (errors of the aspect ratio, low picture quality, fuzzy (not sharp) picture, asynchronous sound - lip sync failure etc.). These errors should be corrected by the supplier or after an agreement in the Czech Television postproduction. If the repair is impossible it must be noted in the programme check report together with the relevant Time Code address.

- **Editorial reminder**

Tests the failure of which is marked as an editorial warning (eg. silence, errors in subtitles or in spelling, non standard picture format etc.) cover phenomena that might be disturbing for the viewer. These errors should be corrected, but if there are convincing programme reasons, it must be noticed in the report together with the relevant Time Code addresses.

Table 7

Name of the test	Fulfilment of the test – obligatory								Entry into the protocol QC
	Permissible variants – SD		Permissible variants – HD						
File Container	MXF Op1a	QT	MXF Op1a	QT	QT	QT/ MXF Op1a	QT/ MXF Op1a	MXF Op1a	Obligatory
Video Codec	IMX D-10	ProRes 422	XDCam HD422	ProRes 422	ProRes 422HQ	DNxHD 185	DNxHD 185X	XAVC-I HD	Obligatory
Video Bitrate	50 Mb/s	>= 41 Mb/s	50 Mb/s	122 Mb/s	184 Mb/s	184 Mb/s	184 Mb/s	100 Mb/s	Obligatory
CBR/VBR	CBR	VBR	CBR	VBR	VBR	CBR	CBR	CBR	Obligatory
Frame Rate	25	25	25	25	25	25	25	25	Obligatory
Aspect Ratio	4:3 , 16:9	4:3 , 16:9	16:9	16:9	16:9	16:9	16:9	16:9	Obligatory
Resolution	720x576	720x576	1920 x 1080	1920 x 1080	1920 x 1080	1920 x 1080	1920 x 1080	1920 x 1080	Obligatory
Color Sampling	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2	4:2:2	Obligatory
Audio Codec	PCM	PCM	PCM	PCM	PCM	PCM	PCM	PCM	Obligatory
Audio Channels	4 (2 x stereo)	4 (2 x stereo)	4 (2 x stereo)	4 (2 x stereo)	4 (2 x stereo)	4 (2 x stereo)	4 (2 x stereo)	4 (2 x stereo)	Obligatory
Sample Frequency	48 kHz	48 kHz	48 kHz	48 kHz	48 kHz	48 kHz	48 kHz	48 kHz	Obligatory
Audio Bit Depth	24	24	24	24	24	24	24	24	Obligatory
Time Code start	10:00:00:00	10:00:00:00	10:00:00:00	10:00:00:00	10:00:00:00	10:00:00:00	10:00:00:00	10:00:00:00	Obligatory

Table 8

Test description	Quality errors description	Test category	Level of test fulfilment	EBU reference	Recommended value and tolerance	Entry into the protocol QC
videosignal levels (inclusive colour gamut)		V	P	0051B	**As in table 1 of this document** (>1% pixels, filtered by lowpass as in EBU R 103)	P
testing PSE (photosensitive epilepsy)	luminance blinking	V	P	0021B	testing PSE – as in offcom 2009	P
black frames (colour mat)	reminder of the short time for the whole area covering colour or black frame	V	RU	0016B	≤2 frames	V
freezed picture	reminder of the short static picture, eg stoptrick	V	RU	0044B	≤ 3s	P
test charts	test charts in the programme	V	TU	0052B	0 frames	V
scanning (video artifacts from the wrong scanning regime)	Signal should be interlaced, but may contain progressive videoformats PSF	V	TU	0038B		P
video dropout	Small video dropouts eg small black squares that might appear in one or two frames	V	TU	0039B		V
field sequence	Fields are reproduced in the wrong sequence causing unpleasant judder (movement errors)	V	P	0041B	odd field as the first	P
sound modulation level "loudness"	Integrovaná hlasitost musí být -23LUFS.integrated loudness should be -23LUFS	A	P	0010B	-23 LUFS ±1 LU	P
audiochannels wrong phase	Phase differences causing audible subtracting signals in mono	A	P	0012B	0 ± 90°	P
maximum acceptable peak audiosignal level	maximal acceptable shorttime peak in audiosignal	A	P	0084B	< -3.0 dBTP	P
audio clipping	digital signal is "clipped", the sound will be distorted	A	RU	0005B	≤ 250ms (12000 samples)	V
audio dropout	short unintended digital sound dropouts	A	RU	0008B	≤ 5ms	V

Test category
A - audio
V - video

Level of test fulfiling
P - obligatory
TU - technical reminder
RU - editorial reminder

Error record
P - obligatory
V - if it occurs

Table 9

Test description	Quality errors description	Test category	Level of test fulfilment	EBU Reference	Recommended value	Error record
programme start	The first programme frame must have the address 10:00:00:00	V	P	0127B	Programme must begin at the address 10:00:00:00.	
visible blocks in picture, coding artefacts	Picture parts especially in dark or high detailed movement look like squares or blocks.	V	RU	0023B	No blocks, squares or edges caused by bad compression or bad video processing may be visible.	V
picture sharpness	Soft or blurred pictures.	V	RU	0050B	Pay attention to sharpness but with regard to depth of field.	V
wrong colour or wrong colour correction	Pictures and especially complexion tones should have a natural look without borders.	V	RU	0087B	Colour correction should not be as aggressive so as not to introduce noise or other visible errors into picture.	V
text in safe area	Many tv sets cut off the picture edges, so-called overscan.	V	RU	0120B	Names and text as part of the picture that is necessary to read must be placed in the title safe area for 16:9.	P
erroneous picture blanking (video frame size)	The screen should be quite filled with the picture, some old or even from analog archives may have black or coloured disturbing edges.	V	RU	0015B	Television frame should be filled without visible remainders of black (or of other pictures) on the edges.	V
black stripes in picture	Reminder about black disturbing stripes (including pillar or letter box on display).	V	RU	0015B		V
disintegrated, burnt/bleached or clipped picture	No loss of details in bright or dark picture parts.	V	RU	0101B	Pictures should not be bleached or merged together.	V
video converse quality (up conversion)	Bad picture processing for HD (when added to the HD programmes) can cause errors and loss of picture quality in comparison with the original version. The converted picture or sequence should not appear to have a worse quality than the original.	V	TU	0053B	Converted pictures (video) should not show any visible impairment that had not been visible in the original version.	V
video noise	Grainy or dotted pictures, may be caused by a too big gain in a scanning equipment.	V	TU	0047B	Pictures should not show any noise, film grain should be minimized.	V
aliasing	Straight edges have a look like moving or having double lines. Static pictures have serrated edges.	V	TU	0126B	Pictures should not show any serrated edges or any pattern like errors (aliasing).	V
erroneous aspect ratio	Picture must not have a look like being stretched or compressed.	V	TU	0121B	Picture content must be linear, eg 4:3 format should not be stretched to fill the 16:9 format.	V
contours	Colour or luminance gradation should be “smooth”, any steps should not be visible.	V	TU	0087B	In picture there should be no visible contours (steps) between different luminance or colour levels.	V

blinking frames	One-frame shots may be disturbing and might lead to the accusation of subliminal advertising.	V	TU	0128B	Shots in duration of 1 or 2 fields should be avoided. Accidental "flash frames" should be corrected.	P
progressive rollers	Subtitle movement should be smooth and must not be too quick to read.	V	TU	0087B		P
noise and interference	Basic electrical noise and other interferences eg from mobile phones.	A	RU	0088B	All disturbing noises like interferences, mains hum, cable cracking, induced radio transmitting and further disturbing noises should be removed if possible.	V
silence	Silent sequences may cause automatic alarms.	A	RU	0077B 0078B	Silence longer than 10 seconds with frozen picture or 5 sec with the black window should be stated in the report.	P
inarticulate dialogue	There are many complaints about inarticulate dialogue.	A	RU	0122B	The sound should be clear and easily understandable for the viewer who is without a script or its copy.	V
inappropriate volume of the "second plane"	Background loudness too high in proportion to dialogue (added effects and music – both being perceived as too disturbing).	A	TU	0122B	Background noise like the traffic noise should not interfere with understandability of the dialogue.	V
cracking	Cracking and further short "sharp" sounds may be very disturbing. An old archive sound should be cleaned always when possible.	A	TU	0057B	Short and sharp sound of crack or click should be repaired.	V
A/V sync (lip sync)	Nesmí existovat žádná detekovatelná chyba A/V synchronizace (retnice nejsou ve zvuku a obrazu současně)No detectable A/V sync error is acceptable (labials in picture and sound are not simultaneous).	A	TU	0098B	Audio/video sync error (lip sync) should be kept within the range +/-10ms.	V
low audio level	Audio level and especially dialogue level should not be so low that the viewer be forced to increase the volume.	A	TU	0077B	Audio level (especially at dialogues) should not lead to adjusting volume during the programme by the viewer.	V
mono (stereo)	Audio standard should be stereo, mono is acceptable particularly for archive, but never should be placed only on one channel.	A	TU	0124B	Mono audio is acceptable and is expected in archive materials and often in programmes with only one dialogue. New material, especially music and effects, should be in stereo.	V
arrangement of audio channels	Arrangement of audio channels depends on the sound possibilities (eg 2. language).	A	P	0123B	Arrangement of audio channels must correspond to the description in documentation.	
phase coherent (particularly surround sound)	Small time differences among the channels may lead to "phasing" or even to disturbing effects by viewers listening surround sound on stereo only tv sets.	A	P	0012B	Surround sound should be checked over the stereo mixer to assure there are no errors especially among the centre and the front left and front right loudspeaker.	