

Technical Guidelines
PLAZAMEDIA GmbH Broadcast Centre



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1. General terms and conditions

These Technical Guidelines define the quality in which the programme features must be delivered for broadcast. The following describes the standards that must be met by film and video productions in terms of tapes or files in order to be released for broadcast. If these requirements depending on their weighting are not met or are deliberately ignored, the responsible production company can be refused technical approval of the programme product and broadcasting of the programme feature.

This document describes the technical standards that must be met by all externally supplied programme elements as well as those produced in-house. All material that is accepted by PLAZAMEDIA GmbH for production, broadcasting and/or further processing, as well as PLAZAMEDIA's own productions, must be delivered in an accepted format along with all the necessary metadata and in line with the present technical quality requirements. In terms of their fundamental technical details, the values specified in these Guidelines correspond to the recommendations of the European Broadcasting Union (UER/EBU) and the cited institutions.

If an external or internal supplier wishes to deviate from the following Guidelines for good reason, they must negotiate this with PLAZAMEDIA or commissioned third-party companies BEFOREHAND and record it clearly in the documents accompanying the material.

Information in the accompanying documents/metadata must be provided even if a production knowingly breaches these Guidelines over a longer period of time. If the technical standards are not adhered to and this leads to a negative result in the quality check by PLAZAMEDIA GmbH or its representative, the contractually agreed (including through these Guidelines) and/or statutory legal consequences will apply.

Both programme preparation and broadcasting operations make use of automation systems. It is therefore of utmost importance that the aspects covered in chapter 5 are observed.



2. Technical parameters

2.1. Video signals

2.1.1 Video signal level and colour spaces

When producing broadcasting content, it must be ensured that no illegal signal-level combinations occur, thereby remaining within the legal colour space.

2.1.2 SD digital video signals

The video signals must comply with the encoding parameters as per ITU-R 601/656 for the 625-line system.

All delivered video signals must meet the current EBU specifications for PAL B/G video without correction. The content must not contain any invalid signal levels (e.g. super black).

Video levels must meet EBU recommendation NR 10 und ITU-R 624-2; i.e. no levels may occur outside the range of 0-100% luminance or 10-100% chrominance.

The white level must not exceed 700mV (component signals) and the black level must not extend below 0V (DC). The programme luminance in neither white nor black should be excessively clipped.

If an offset of 350mV was set, the colour difference signals R-Y and B-Y must not exceed a level of 700mV or fall below 0mV.

Active picture information must extend from line 23 to line 310 in the first field and from line 336 to line 623 in the second field. As well as the VITC information, there may also be vertical blanking information.

Note:

Following D/A conversion, the digitally generated video signals must not have any unduly steep edges (10% to 90%), luminance below 100 ns or chrominance below 200 ns (at least 3 samples per edge).

Because programmes are generally broadcast using the PAL standard, the component signal must allow PAL encoding that complies with the standard. Any deviations must be agreed with the client. At PLAZAMEDIA, the video signals are processed in serial digital component format at all stages.

Compliance with the PAL colour space (GBR) is monitored using "Quality Advisor". RGB colour space monitoring is also possible as an option.



2.1.3 HD digital video signals

In general, digitally generated or digitised vision signals must meet the coding parameters according to ITU-R BT.709-5.

All delivered video signals must meet the current EBU specifications for PAL B/G video in the down conversion without correction.

There must not be any invalid signal levels in the content (e.g. super black).

2.1.4 Tolerances on gamut values

For programme material that is used for programme exchange or for broadcasting, the nominal video level should only briefly be above the signal level specified in ITU-R 601 for SD and ITU-R BT.709 for HD.

Note: The headroom allowed for in the ITU specification is intended for unavoidable short-term overshoots due to technical reasons, e.g. transient response of filters, unexpected peaks during pan move.

Excerpt from EBU R103:

Tolerances on colour gamut

The EBU recommends that the colour gamut in television programme material can be accepted if both the following conditions are met:

- When matrixed to RGB, all of the R, G or B signals should lie inside the range -5% and 105%
- The resultant luminance signal should lie inside the range -1% to 103%

This means that in the level assessment during waveform measurement, a Y-value of **-7mV to +721mV** is still within the tolerances.

The limits for the briefly high-frequency peak values are the result of the quantisation limits for Y of **-7% to +9%**, for C of **+/- 7%**

2.1.5 Aspect ratio

The picture aspect ratio must be consistently maintained and indicated upon delivery of the material. The possible aspect ratios for SD and HD material are defined below.



SD aspect ratio

The terms 4:3 (1.33:1) and 16:9 (1.78:1) describe the aspect ratio of an image, i.e. the ratio of width to height.

The resolution of an SD (Standard Definition) TV picture is 720 pixels x 576 lines in both 4:3 format and 16:9 format.

HD aspect ratio

The technical size of the active picture is 1920x1080 square pixels; no other sizes will be accepted.

Broadcasting standard

Programmes will broadcast either in 4:3 aspect ratio or in 16:9 full format (anamorphic). Aspect ratios must not be mixed in features.

The signals supplied must not contain Wide Screen Signalling (WSS) or Video Index (VI).

16:9 full format

Format specification for a programme in SD TV that is only displayed with the correct geometry at an aspect ratio of 16:9 or 1.78:1 on a display that supports 16:9.

4:3

| | |
|--------------------------|---|
| Active picture | = Lines 23-310/336-623, 702 pixels (52µs) |
| Action safe area | = Lines 38-295/351-608, 632 pixels (52µs) |
| Title/graphics safe area | = Lines 45-289/358-601, 596 pixels (52µs) |

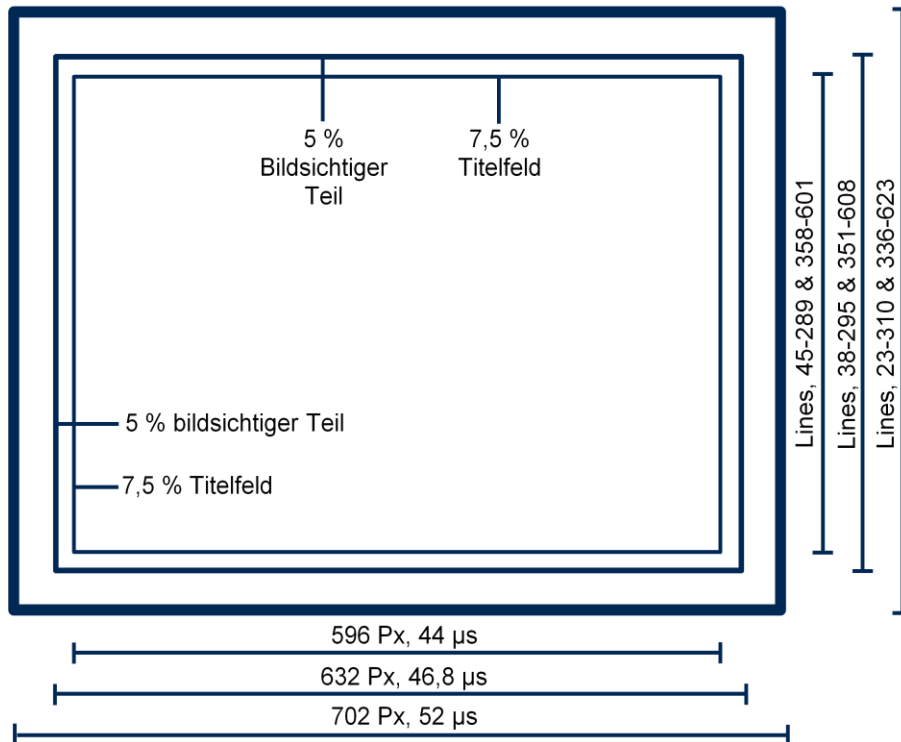
16:9

| | |
|--------------------------|---|
| Active picture | = Lines 23-310/336-623, 702 pixels (52µs) |
| Action safe area | = Lines 33-300/346-613, 652 pixels (52µs) |
| Title/graphics safe area | = Lines 38-295/351-608, 562 pixels (52µs) |



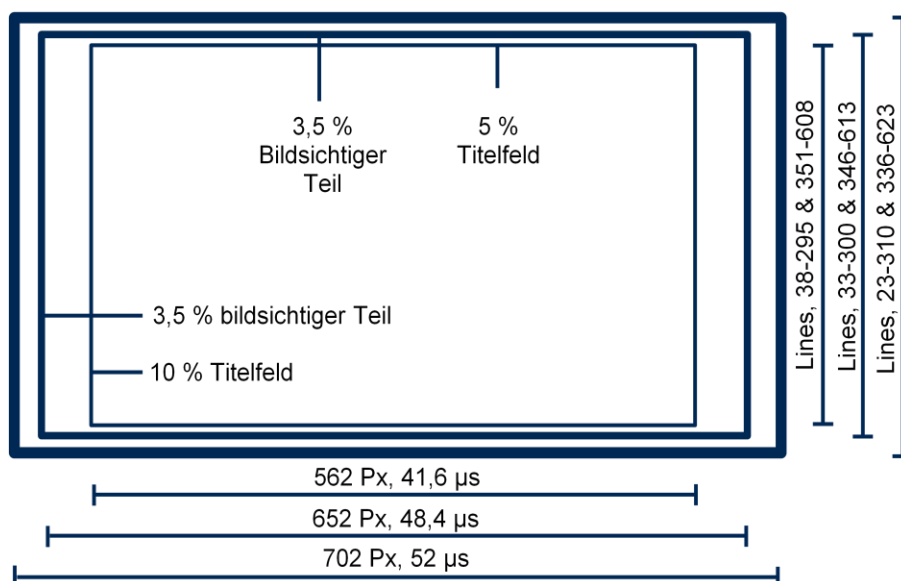
Structure of a 4:3 Aspect ratio

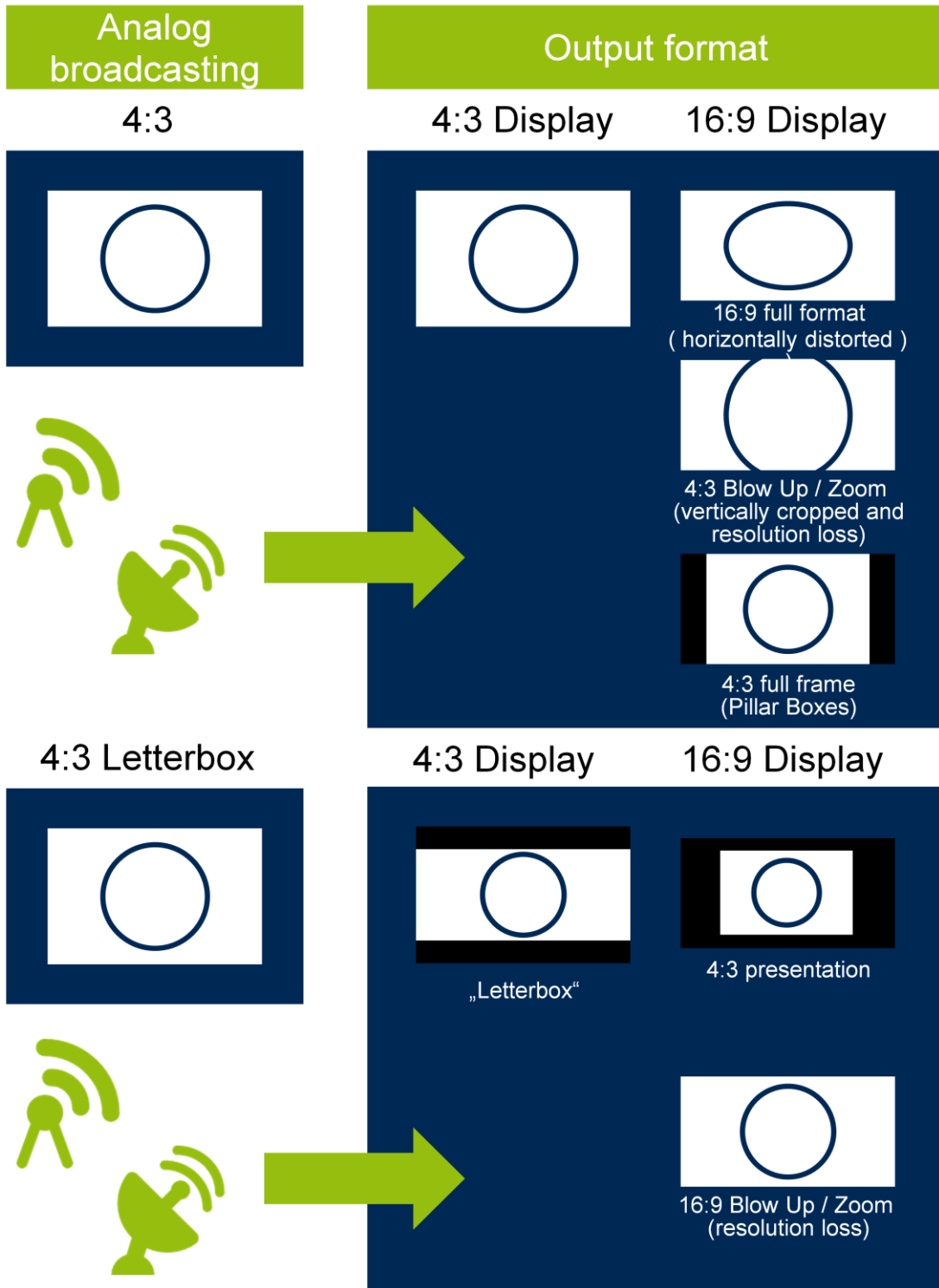
Illustration 1

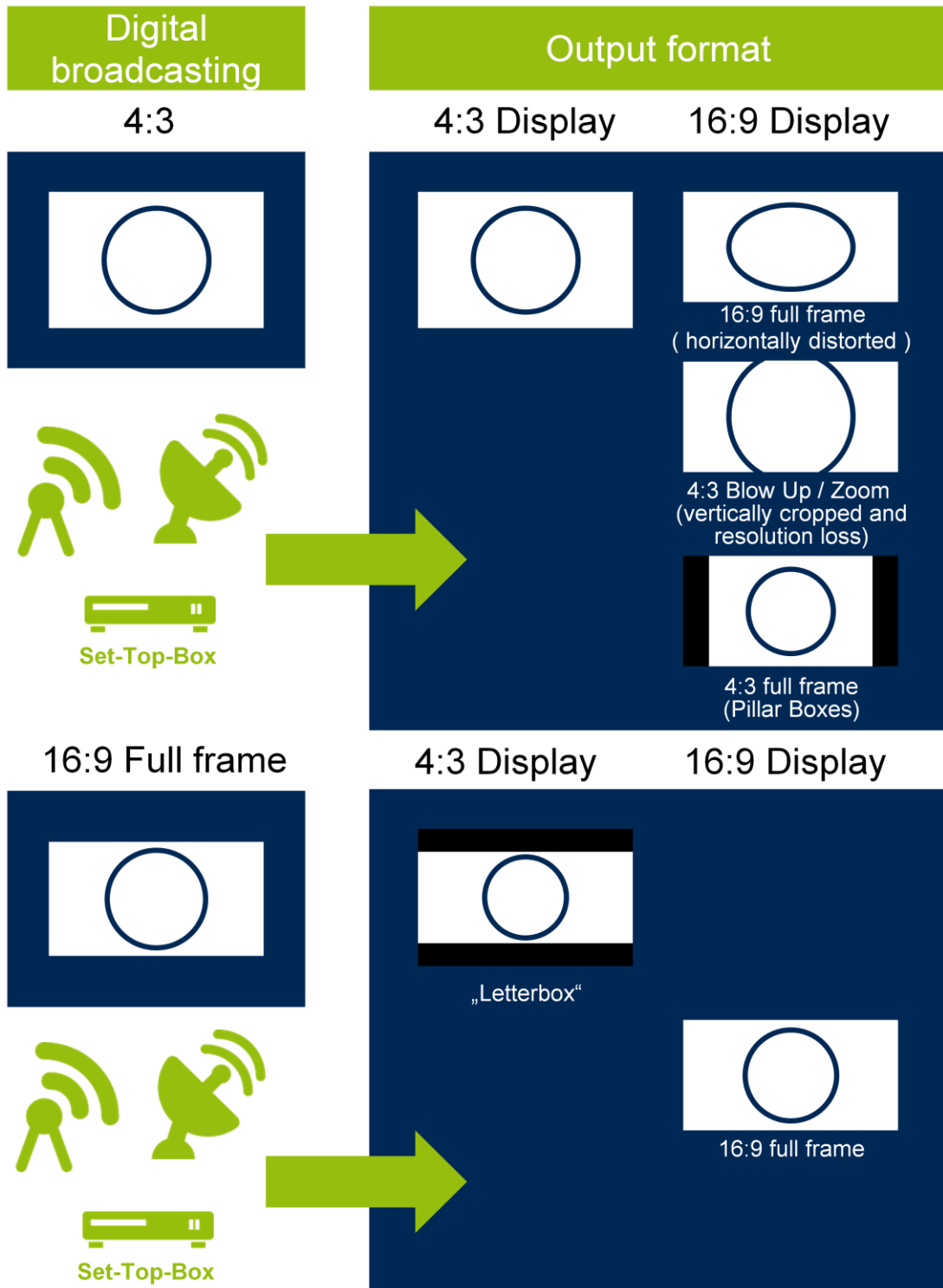


Structure of a 16:9 Aspect ratio

Illustration 2







2.1.6 Frame rate and field dominance

Only a frame rate of 50 fields (SD/HD) will be accepted.

A shot change of a vision signal to be recorded must begin with Field 1 (see also EBU Recommendation R62).

In general, the correct field dominance must be maintained for all equipment involved in a production (mixer, synchroniser, etc.).

For the production of programme material, the time for all editing equipment must be set so that the added and inserted picture material begins with Field 1 of a frame (Field 1 is defined in ITU Report 624 for system B, G/PAL).

When recording from a film scanner, the beginning of a new film frame must coincide with the beginning of Field 1 of the TV signal.

2.1.7 Avoiding flickering pictures

Flickering or flashing images and certain types of repetitive optical patterns can cause photosensitive epilepsy (PSE) in susceptible viewers and must be avoided. At least nine individual images must be positioned between two flickering or flashing images, and any regular prominent patterns (such as bars or spirals) that cover large areas of the picture must be avoided.

2.2. Audio signals

2.2.1. General parameters

The following audio levels apply at PLAZAMEDIA:

| | Analogue | | Digital | ITU |
|-----------------|----------|--------|----------------------|------|
| Peak level | 0 dB | 6 dBu | -9 dBFS (full scale) | 100% |
| Reference level | -9 dB | -3 dBu | -18 dBFS | 35% |

The following sound track assignments apply at PLAZAMEDIA:

| | Track 1 | Track 2 | Track 3 | Track 4 |
|--------|----------------------|----------------------|----------------------|----------------------|
| Stereo | Left channel | Right channel | Int. left channel | Int. right channel |
| | Left channel | Right channel | Left channel | Right channel |
| Mono | Mono programme sound | Mono programme sound | Int. mono | Int. mono |
| | Mono programme sound | Mono programme sound | Original mix | Int. mono |
| | Mono programme sound | Mono programme sound | Mono programme sound | Mono programme sound |



| Two-channel sound | Track 1 | Track 2 | Track 3 | Track 4 |
|-------------------|----------------------|---------------|---------------------------|----------------------------|
| Mono / mono | Mono programme sound | Original mix | Int. mono | Int. mono |
| | Mono programme sound | Original mix | Mono programme sound | Original mix |
| Stereo / stereo | Left channel | Right channel | Original mix left channel | Original mix right channel |
| | Left channel | Right channel | Int. left channel | Int. right channel |

Exception:

In the case of recordings to which sound is to be added live during broadcast, tracks 1, 2, 3 and 4 must be assigned Int. sound.

Stereophonic programme features must be mono-compatible. In line with CCIR Rec. 408, the degree of correlation between the left and right channels must be greater than or equal to zero. A good stereo recording has a degree of correlation of 0.7. Any deviations downward from this figure may only occur for brief periods. If mono sound is to be formed from genuine stereo signals, this should be done with a 90° filter. If this guideline is not observed, the sound is lost on mono television receivers.

2.2.2. Analogue audio signals

The maximum available dynamic transmission range of 40 dB must already be taken into account during production. The analogue level meter used must comply with the IEC publications 268-10 and DIN 45406.

2.2.3. Digital audio signals

2.2.3.1 Headroom and maximum level

In accordance with the recommendation in ITU-R 777, the encoding value for the reference level must be 18 dB below the maximum possible encoding value. This results in a headroom of 9 dB.

The digital level meter used must comply with ITU-R 777 and must use an integration time of 10 ms. Isolated level peaks must not exceed a value of -6 dBFS.

2.2.3.2 Loudness standard EBU R128

Audio signals must be adjusted, measured and normalised according to ITU-R BS. 1770-2 and EBU R128.



Programme loudness and normalisation

The programme loudness must be adjusted to a target level of -23 LUFS. Any deviation from the target level must not exceed +/- 1 LU. This applies to programmes that do not allow exact normalisation to the target level, e.g. live programmes.

Permitted maximum level

The exact maximum peak level for PCM audio is -3dBTP (dB true peak).

Loudness range

The permitted loudness range for stereo and 5.1 productions must not exceed 20 LU.

Programme loudness for short elements (commercials, trailers, sponsorship credits)

For short elements such as commercials, trailers and sponsorship credits, the above-mentioned levels apply, however the following levels are permitted:

Momentary loudness max. (400 ms) -15 LUFS (+8 LU)

Short-term loudness max. (3 s) -20 LUFS (+3 LU)

2.2.3.3 Sampling rate

Only digital sound signals with a sampling rate of 48 kHz may be used.

2.2.3.4 Bit depth

If a resolution greater than 20 bit is used during production, this must be converted to 20 bit using a suitable dither algorithm before transfer to Digital Betacam, since this only supports 20-bit recordings.

2.2.3.5 Pre-emphasis

Pre-emphasis must never be used.

2.2.3.6 Dolby E / AC3

Dolby E channel configuration 5.1 + 2 (if a stereo programme is provided [e.g. with Int. or mix]), otherwise 5.1

AC3 metadata:

Extended BSI: on

AC3 metadata: Enabled

Dialogue norm level: -27 dB, or higher in the case of compressed material

Surround format: 3/2 at 5.1, 2.0 for stereo programmes

Surround 3dB att: off

Surround phase shift: off

LFE enable: off, if not used (sports)

Line mode compression: film light

RF overmodulation: on

Center downmix: -3 dB

Surround downmix: -3 to -6 dB depending on the proportions in the surround

Dolby surround: only On if the material is surround-encoded

DC filter: on

Lowpass filter: on



The Dolby E encoding delay (40 ms) should be compensated for during production. As a rule, atmosphere and effects should be pre-compressed as little as possible. A limitation to -9 dBFS is not necessary. Commentary is generally mixed in the centre. However, the downmix parameters (LCR downmix level in the Extended BSI) must be set in such a way that the commentary can be clearly understood when played back in both stereo and mono. (If in doubt, reduce the surround downmix level.) Because surround signals are not recognisable as such, they must be clearly marked as "Surround" in the VTR card, on the carrier or in the metadata.

The microphone arrangement should be chosen in such a way that the audible coverage is as large as possible, as most viewers will not be sitting in the sweet spot.

3. Magnetic tape recording

3.1. Transmission formats

The transmission formats for magnetic tape recording at PLAZAMEDIA are Digital Betacam and HD Cam.

The broadcast tapes for Digital Betacam must comply with the ITU specification and the parameters in the ITU-R 601/656 standards. Recordings on HD Cam must comply with the ITU-R 709 guidelines. The audio recording must meet the AES/EBU recommendations and IEC 958 and the specifications laid down in the chapter on "Audio signals".

In this context, your attention is again explicitly drawn to the fact that for programme tapes and advertisement tapes, audio tracks 1, 2, 3 and 4 must contain at least mono-compatible programme sound.

3.2. Recording parameters

3.2.1. Time code

The time code must be continually increasing. The values for LTC and VITC must be identical.

LTC:

The longitudinal 80-bit time code must comply with the specifications in DIN 45484, IEC 461 and EBU 3097. The Color Framing Log Flag (bit no. 11) must be set, i.e. the time code must be locked to the colour carrier. The level must correspond to maximum level.



VITC:

The 90-bit time code must comply with the specifications in IEC 461 and EBU 3092. The VITC must be recorded in lines 19 and 21, and 332 and 334.

3.2.2. Technical leader

To allow the replay machine to be ideally matched to the material to be replayed, every feature needs a technical leader, that **must** be recorded using the recorder used to record the programme. The programme recording must start at 10:00:00:00.

With the file formats the programme starts at 00:00:00:00 (see also chapter 6).

| TC | Video | Audio |
|---------------------------|--------------------------------------|--|
| 09:58:00:00 | Colour bar (100/0/75/0) ITU-R 471 | Reference tone analogue: 1kHz -9 dB digital: 1kHz -18 dBFS |
| 09:59:30:00 | Black | Mute |
| 10:00:00:00 | Programme | Programme |
| Trailer at least 30 s. | Black | Mute |

The colour bar used should comply with ITU 471:

A colour bar in order of brightness in the top two thirds of the image and a constant red area in the lower third of the image. The video level should be 100% for white and 75% for the colours (100/0/75/0). The sync signal, the control track and the time code must be constantly present without interruption from the start of the technical leader through to the end of the trailer.

3.2.3. Programme recording

Different versions of the same programme feature and different programme features on the same tape are not permitted and will not be accepted by PLAZAMEDIA. This applies in particular to advertising items.

If a production comprises several tapes, the same tape type and manufacturer must be used.

Recording to Digital Betacam must conform to the PAL 8 sequence. Point 2.7 of the ITU-R 601 guideline applies accordingly.

Recordings on HD Cam must comply with the ITU-R 709 guidelines.

To achieve the highest possible quality of the broadcast material, the number of copy operations needed must be kept to a minimum.



3.2.4. Error rate

When recording digital components, it must be ensured that the error rate does not exceed permitted limits on any recording or playback operations. The "channel condition" indicator signals the following operating states:

- Green** The status of all playback channels is good.
Any errors which arise can be corrected.
- Yellow** Increased error rate.
All errors can still be corrected, but it is possible that there is an underlying problem (dirty heads, excessive tape wear).
- Red** High error rate.
It is no longer possible to correct all errors. Blocking is visible in the image and/or sound interference can be heard.

The transition from yellow to red only takes place with a small margin of safety!

During transfer, the recording machine does not record this information, so this indicator must be carefully observed during such an operation.

3.2.5. VTR card

A VTR card must be enclosed with every production and every programme tape. The VTR card must contain all the required specifications as shown on the sample VTR card.

Every tape, every sleeve and every VTR card must be labelled in such a way that they can be identified quickly and easily.

3.2.6 Video cassettes

Only video cassettes from recognised, qualified manufacturers may be used. At PLAZAMEDIA, the only cassettes that are used are those which are either new or which have been deleted and cleaned using the "Tape Check System" (PLAZAMEDIA VTR room) or a comparable system.

A printout is produced for each tape showing the category and any errors. Tapes which have not been deleted are not used for reasons of broadcast security. Because contamination can rapidly spread from VTR to VTR when cassettes are transported, we urgently ask you to support this procedure.



3.2.7 Technical quality check

PLAZAMEDIA GmbH reserves the right to subject received material to an automatic quality check. The main focus of the check is on whether the programme is suitable for broadcasting and further processing and whether it meets the essential quality requirements.

The technical quality check conducted upon feed-in is based on **clear** parameters that are directly related to the delivery standards described in this document.

PLAZAMEDIA GmbH reserves the right to reject delivered material that does not meet the standards described in this document.

4. Outside broadcasts and transmission over dedicated lines

4.1 Outside broadcasts

The same general terms and technical parameters already described in chapters 1 to 3 must also be observed for outside broadcasts.

4.2 Transmission over dedicated lines and satellites

Video and audio signals are to be regarded as belonging together when transferring programme features or during live transmissions. The person responsible for the production must ensure that a transfer point that is freely accessible to every communications service provider is made available for the transfer or live transmission of productions.

4.2.1 Picture transfer

When programs are transferred over dedicated lines, satellites or networks similar to dedicated lines such as ATM, the FTZ [155 R 157] guideline and section 4.7.1.2 in the "Handbuch Fernsehbetriebstechnik" (Television Operating Technology Manual) must be observed. It is recommended that a programme source identifier is included by injecting a text into the test card.

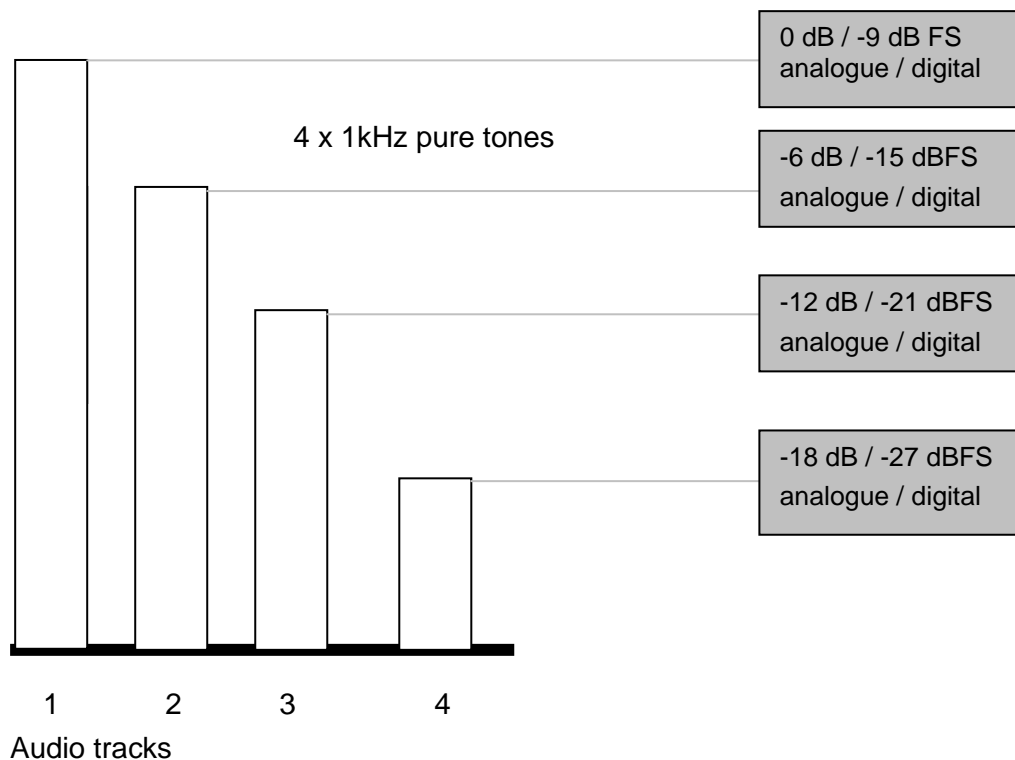
The chosen standard must be agreed between the producer and PLAZAMEDIA GmbH or its respective service provider (MTI Teleport Munich) and also requires the approval of PLAZAMEDIA Production.

4.2.2 TV audio transmission

When transferring the TV audio over dedicated lines, satellite or networks similar to dedicated lines, priority must be given to observing the interface constraints for the sound parameters as given by the transfer medium (e.g. maximum level, etc.).



In this context, the following guidelines must be observed: [FTZ 154 R 1,4] and [FTZ 154 R 1,5]. A 1-kHz tone with a reference level of -9 dB (analogue) or -18 dBFS (digital) must be used as a reference tone for the maximum level. If the sound is transferred over a different route from the video, it must be paid attention to ensure lip-synchronisation of sound and picture. A lip-sync tape (running clock with signal tone) is to be used. Correct lip synchronisation of sound and picture and the correct assignment of audio tracks must be checked using the lip-sync test and throughout the subsequent cascade prior to each transfer.



4.2.3 Dolby Digital live production

For the current Dolby Digital production, the following requirements and procedures are necessary to ensure that the production runs smoothly:

- The OB van must have a Dolby E encoder and a video-frame synchroniser to compensate for the encoding delay (40 ms).
- The uplink must have a Dolby E-compatible multiplexer.
- It must be guaranteed that a continuous stream of data is transferred throughout the entire production period, including any breaks.
- Before production begins, sufficient time must be guaranteed for calibrating the transmission link.
- Only after calibration error-free, synchronous operation is possible.
- If the data stream is interrupted, the transmission link must be recalibrated.



The Dolby E data stream must contain the metadata defined in section 2.2.3.7 Dolby E / AC3. The assignment of the sound channels (see sound track assignments in section 2.2.1) must be agreed between the producer and PLAZAMEDIA GmbH and also requires the approval of PLAZAMEDIA Production.

4.2.4 Dolby E frame positioning

Because the Dolby E data stream can only be edited or switched without errors every 40 ms, the positioning of the Dolby E frame in relation to the video frame must be correct.

1080i/50 : Dolby E frame length = 1826 Dolby E ref. timing = 743µs (+/-40µs)
 Line position (+/-1 Line) = 19 Latest line pos. (+/-1 line) = 54

4.2.5 Digital transfer

With digital transfers over dedicated lines or networks similar to dedicated lines such as ATM and over satellites, the transfer parameters must be agreed with the client beforehand. The point of contact is the line booking office of the client. The following transmission standards are possible and must be agreed and specified in a binding form prior to transfer:

| | | |
|------------------|-------------|----------------|
| ETSI | G.703 | 34 Mbit/s |
| DVB-MPEG2 | 4:2:0 MP@ML | 8 - 15 Mbit/s |
| DVB-MPEG2 | 4:2:2 P@ML | 15 - 45 Mbit/s |

4.2.5.1 Digital transfer via satellite

The following stipulations must be observed in addition to 4.2.1 and 4.2.2:

All digital satellite transmissions must be carried out using the transmission standards named in 4.2.5.

As a rule, the modulation type QPSK is to be used.

It must be possible to encrypt the transmission, but this must be agreed in detail in each case between the line booking office and the corresponding receiving point.

As a rule, SCPC (Single Channel per Carrier) is used. MCPC (Multi Channel per Carrier) is a special case and must be individually agreed beforehand.

The following signal parameters must be specified in a binding form before each transmission:

- Satellite and orbital position
- Satellite transponder used (sub-transponder if necessary)



- Downlink frequency and polarisation
- Compatibility between decoder and encoder
- Encoding ETSI G.703; MPEG-2MP@ML; 4:2:P@ML
- Net bit rate 34 Mbit/s; 2 to 15 Mbit/s; 8 to 45 Mbit/s
- FEC
- Line standard PAL/NTSC
- Number and assignment of audio channels
- Encryption algorithm if required (e.g. RAS-2, BIZZ etc.)

In the case of digital SNG transmissions (DSNG), MPEG-2 is the only transmission standard permitted by DVB-S (Digital Video Broadcasting for Satellite).

Unless otherwise agreed, MP@ML with a bit rate of 8.448 Mbit/s including an audio data stream (2-channel) of 256 kbit/s is used for DSNG.

At an RS factor of 204/188 and an FEC of $\frac{3}{4}$, this gives a symbol rate of 6.1113 Msym/s, and with QPSK modulation and a resulting roll-off of 35% and SCPC, it gives a bandwidth of 8.25 MHz.

4.2.5.2 Contacts at MTI

MTI Teleport München GmbH is PLAZAMEDIA's service provider for satellites and fibre optics.

Marketing:

David Müller

Tel: +49 8192 933419 Mobile: +49 172 7081070

E-mail: david.mueller@mti-teleport.de

Line booking office:

Line booking office

Tel: +49 89 206099910

E-mail: booking@mti-teleport.de

Technical queries – fibre-optic network:

Andreas Sabo

Tel: +49 89 99536647 Mobile: +49 172 7081066

E-mail: andreas.sabo@mti-teleport.de

Technical queries – satellites/satellite transmission room:

Reinhard Graf

Tel: +49 89 206099950 Mobile: +49 172 7081060

E-mail: reinhard.graf@mti-teleport.de



4.2.5.3 Digital transfer via NGN

PLAZAMEDIA uses the broadcast NGN of Media Broadcast for audio, video and data transfer services in real time. The scheduling of the switching connection occurs on the central scheduling system SYLT, on which the Broadcast Network Terminal (BNT) is based and with which independent connections can then be switched.

PLAZAMEDIA uses the Broadcast Network Service (BNS), which allows the following formats:

- MPEG-2 connections
- H.264/MPEG-4 connections
- DVB/ASI connections
- Voice connections
- Ethernet connections
- International connections
- MeXS (automated file transfer)
- MB Internet

4.3 Command integration

4.3.1 Commands via telephone hybrid

The line input/output level must conform to the broadcasting house level of +6 dBu.

4.3.2 Commands via ISDN codec

The following standards must be taken into account when establishing an ISDN codec:

- | | |
|------------------|-----------------------------|
| - Connection | Euro ISDN |
| - Type algorithm | MPEG-2 Layer 2 |
| - ISDN bit rate | 128 kbit/s (two B channels) |
| - Sample rate | 48 kHz |
| - Operating mode | Dual Mono (or Joint Stereo) |

Codecs used:

- Mayah Centauri 3001
- Mayah C1161
- Musictaxi VP Pro
- CDQ Prima



5. Automation systems

In the PLAZAMEDIA broadcasting centre, all broadcasting stations are handled by an automation system.

Basic requirements

VTR playout:

The time code must be present constantly and increasing over the entire recorded length of the tape. Jumps in the TC or different TC values (LTC / VITC) on a programme tape will inevitably lead to the feature being broadcast for too long or too short a time.

Programme tapes must be produced in such a way that they can be played back using the default settings of the VTR equipment. The video and audio signals can no longer be corrected during broadcast. This particularly affects the assignment of audio tracks 1, 2, 3 and 4.

VTR labels may only be attached to the intended surface on the top of the cassette.

The tape material must be delivered in sufficient time for it to be prepared for broadcast and for the material to become acclimatised.

If one of these issues is ignored, it is possible that individual parts or the entire feature **cannot** be broadcasted.

File-based delivery / playout:

The versions of the hardware and software used by the external service provider that were valid and checked at the beginning of the contract, and the compatibility of these with the current software and firmware of the playout server in the broadcast centre, serve to ensure the standards of quality.

Changes to the production process of the external service provider can only be deployed in the productive system after consultation with the system administration staff at PLAZAMEDIA Broadcasting Operations and after such changes have been explicitly approved.



6. Postproduction / Central file ingest

PLAZAMEDIA's Postproduction department works with the following systems, preferably tapeless: Avid Media Composer and EVS Server.

6.1 Defined file and tape standards

6.1.1 Defined file standard in postproduction for delivery of raw material

To simplify ingest into the postproduction systems, the raw material should be delivered in the following file formats:

DNxHD 120 (QT or MXF container: .mov / .mxf)

Audio: 4-channel 48 kHz / 24 bit

XDCam 50 Mbit (MXF container: .mxf)

Audio: 8-channel 48 kHz / 24 bit

The audio broadcast standard R128 does not need to be observed for the delivery of raw material. The material can be delivered on any media, preferably Windows NTFS volumes. FTP file transfer can be carried out in consultation with the Central Ingest department. Basically, the delivering party is responsible for ensuring correct delivery.

In the case of any deviation from the defined file standard, the Central Ingest department will transcode the material free based to DNxHD120

If files that do not comply with the technical guidelines are used, PLAZAMEDIA cannot guarantee the technical quality or usability.

In individual cases the files should be checked for broadcastability on the instruction of Central Ingest.

6.1.2 Defined tape standard in postproduction for raw material delivery

| | |
|-----------------|--|
| HD-Cam SR | Ingest compressed DNxHD120 via single link |
| HD-Cam | Ingest compressed DNxHD120 |
| XDCam50 | Ingest DNxHD120 / optional XDCam 50 Mbit |
| P2 card HD/SD | Ingest DNxHD120 / Ingest MXF Mpg50 |
| Digital Betacam | Ingest compressed MXF Mpg50 |
| Analog Betacam | Ingest compressed MXF Mpg50 |
| DV25 | Ingest MXF DV25 420 |
| DV50 | Ingest MXF Mpg50 |

We cannot process DVC/DVCPro, MII, U-Matic HB/LB, Video8, Hi8



6.1.3 Defined tape standard in postproduction for programme delivery

(Processing in postproduction with voice, packaging, finishing, transfer)

| | |
|-----------------|--|
| HD-Cam SR | Ingest compressed DNxHD120 via single link |
| HD-Cam | Ingest compressed DNxHD120 |
| XDCam50 | Ingest DNxHD120 / optional XDCam 50 Mbit |
| P2 card HD/SD | Ingest DNxHD120 / Ingest MXF Mpg50 |
| Digital Betacam | Ingest compressed MXF Mpg50 |
| Analog Betacam | Ingest compressed MXF Mpg50 |
| DV50 | Ingest MXF Mpg50 |

We cannot process DVC/DVCPro, MII, U-Matic HB/LB, Video8, Hi8.

6.1.4 Defined file standard in postproduction for programme delivery

(Processing in postproduction with voice, packaging, finishing, transfer)

If delivered via file, the programme must start at time code 00:00:00:00, if delivered via tape, the programme must start at time code 10:00:00:00.

High Definition:

| | High Definition Delivery Tape / Cartridge | High Definition Interlaced Delivery Tapeless | | | High Definition Progressive Delivery Tapeless | |
|------------------|---|--|------------------------------|--------------------------|---|--------------------------------|
| | | Option 1 | Option 2 | Option 3 | Option 1 | Option2 |
| Standard | HD | HD | HD | HD | HD | HD |
| Video resolution | 1920 x 1080 | 1920 x 1080 | 1920 x 1080 | 1920 x 1080 | 1920 x 1080 | 1920 x 1080 |
| Picture format | 16x9 | 16x9 | 16x9 | 16x9 | 16x9 | 16x9 |
| Frame rate | PAL 50i | PAL 50i | PAL 50i | PAL 50i | PAL 25p | PAL 25p |
| Supply | HD-Cam tape | | | | | |
| Codec | | DNxHD 120 (Avid) | | | DNxHD 120 (Avid) | |
| File format | | MXF or Quicktime | Quicktime Pro-Res 4:2:2 / HQ | XDCam HD 4:2:2 / 50 Mb/s | MXF or Quicktime | Quicktime or AVI un-compressed |



| | | | | | | |
|-------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Audio level | Max. -9dBFS AES/EBU | Max. -9dBFS AES/EBU | Max. -9dBFS AES/EBU | Max. -9dBFS AES/EBU | Max. -9dBFS AES/EBU | Max. -9dBFS AES/EBU |
| Audio spec. | | 48 kHz / 24 bit | 48 kHz / 24 bit | 48 kHz / 24 bit | 48 kHz / 24 bit | 48 kHz / 24 bit |
| EBU | R128 | R128 | R128 | R128 | R128 | R128 |
| Tracks | CH1 – Mix L | CH1 – Mix L | CH1 – Mix L | CH1 – Mix L | CH1 – Mix L | CH1 – Mix L |
| | CH2 – Mix R | CH2 – Mix R | CH2 – Mix R | CH2 – Mix R | CH2 – Mix R | CH2 – Mix R |
| | CH3 – IT L | CH3 – IT L | CH3 – IT L | CH3 – IT L | CH3 – IT L | CH3 – IT L |
| | CH4 – IT R | CH4 – IT R | CH4 – IT R | CH4 – IT R | CH4 – IT R | CH4 – IT R |
| Time code | Continuous TC | Continuou s TC | Continuou s TC | Continuou s TC | Continuou s TC | Continuous TC |

6.2 Standard Definition

| | Standard Definition Delivery Tapeless | |
|------------------|---------------------------------------|---------------------|
| | Option 1 | Option 2 |
| Standard | SD | SD |
| Video resolution | 720x576 | 720x576 |
| Picture format | 16x9 anamorphic | 16x9 anamorphic |
| Frame rate | 50i | 50i |
| Codec | MPEG50 (Avid) | DVCPRO50 (50 Mb/s) |
| File format | MXF file | MXF file |
| Audio level | Max. -9dBFS AES/EBU | Max. -9dBFS AES/EBU |
| EBU | R128 | R128 |
| Audio spec. | 48 kHz / 24 bit | 48 kHz / 24 bit |
| Tracks | CH1 – Mix L | CH1 – Mix L |
| | CH2 – Mix R | CH2 – Mix R |
| | CH3 – IT L | CH3 – IT L |
| | CH4 – IT R | CH4 – IT R |
| Time code | Continuous TC | Continuous TC |



Specifications for loudness-normalised sound adjustment as per EBU R128 for commercial and trailer production as of 31.08.2012:

Target level for programme loudness: -23 LUFS (0 LU)

Measured over the entire duration of the programme feature

Maximum momentary loudness: -15 LUFS (+8 LU)

Maximum short-term loudness: -20 LUFS (+3 LU)

These levels correspond to the *Practical Guidelines* (EBU Tech 3343), section 10.1 *Commercials (Advertisements) and Trailers*.

Maximum permitted true peak level: -1dBTP

For coded signals (Dolby): -3dBTP

With normal features there is no restriction on momentary and short-term loudness (only applies to commercials)

6.3 Output formats

6.3.1 Defined output formats for postproduction of master tapes (dubbing on request)

| | |
|-----------------|---|
| HD-Cam SR | Playout compressed DNxHD120 via single link |
| HD-Cam | Playout compressed DNxHD120 |
| XDCam50 | Playout XDCam 50 Mbit |
| Digital Betacam | Playout compressed MXF Mpg50 |

All output formats correspond to the EBU R128 standard.

6.3.2 Defined output formats for postproduction of broadcast files

| | |
|----------------------|----------------------------------|
| XDCam 50 Mbit | (MXF container: .mxf) |
| | Audio: 8-channel 48 kHz / 24 bit |

The output format corresponds to the EBU R128 standard.



6.3.3 Output formats for postproduction via central file ingest

Any file output formats can be implemented via instruction from the Central Ingest department. This requires an obligatory detailed codec description. Once the conformity has been checked, the files can be transferred via data media or FTP.



7. File formats / Video compression Broadcast Operations

File formats are defined in accordance with the SMPTE standards 292M (HD) and SMPTE 295M (SD), or ITU-R BT.601.

7.1 HD video

The video data rate used for HD is 18-85 Mbit/s (MPEG2 Long GOP), or 50-100 Mbit/s (MPEG2 I-Frame only). 4 tracks are used for the audio signal with AES/EBU (24-bit resolution/sampling value at a sampling rate of 48 kHz), or SDI_{embedded}.

The HD video format at PLAZAMEDIA is 1920 x 1080 50i; all common formats can be converted.

DOLBY E (see 2.2.3) can be used as the transmission method for 5.1.

The format must be specified when a new customer is connected.

Metadata should be delivered in XML format (see example below).

Delivery via FTP, hard disk, solid-state drives or similar.

7.2 SD video

The video data rate used for SD is 3-25 Mbit/s (MPEG2 Long GOP) or 25-50 Mbit/s (MPEG2 I-Frame only) and IMX 50.

4 tracks are used for the audio signal with AES/EBU (24-bit resolution/sampling value at a sampling rate of 48 kHz), or SDI_{embedded}. The Quicktime container or MXF is used as the wrapper.

See table below for more details:

File formats for broadcasting

| | XDCam HD | SD video | Commercials |
|--------------|---|---|---|
| Container: | MXF OP1A self-contained XDCam HD 422 in MXF container | MOV – QT7 referenced (mov, m2v and wav) | MOV – QT7 referenced (mov, m2v and wav) |
| Video | | | |
| Resolution: | 1920 x 1080 | 720 x 576 | 720 x 576 |
| Aspect: | 16:9 | 4:3 or 16:9 (anamorphic) | 4:3 or 16:9 (anamorphic) |
| Codec: | MPEG2 LGOP (422P@HL, MPEG HD422) | MPEG2 LGOP | MPEG2 I-Frame only |
| GOP length: | 12 | 15 | 1 |



| | | | |
|-------------------------|---|---|---|
| | (IBBPBBPBBPBB) | | |
| Sub GOP length: | 3 | 3 | 1 |
| Frame rate: | 25 | | |
| Sequence header: | on each GOP | | |
| Field dominance: | Top field first | | |
| Bit rate: | 50 Mbit/s | 12 Mbit/s | 12 Mbit/s |
| Chroma subsampling: | 4:2:2 | 4:2:0 | 4:2:0 |
| IntraDC Precision: | 10 bit | | |
| Audio | | | |
| Codec: | PCM | PCM | PCM |
| Sample rate: | 48 kHz | 48 kHz | 48 kHz |
| Bits/sample: | 24 | 24 | 24 |
| Max. channels per file: | 8 / 4 stereo pairs | 4 | 4 |
| Track assignment | | | |
| Track 1 – 2: | German mix | | |
| Track 3 – 4: | Original soundtrack, Int. or MUTE | | |
| Track 5 – 6: | Dolby E – German in 5.1 (L, R, C, LFR, Lx, Rs) + metadata or MUTE | | |
| Track 7 – 8: | Dolby E – Original in 5.1 (L, R, C, LFR, Lx, Rs) + metadata or MUTE | | |
| Time code | | | |
| | SMPTE 328m time code in picture user data | - First frame information as user data in Omneon format | - First frame information as user data in Omneon format |
| | | - SMPTE 328m time code in picture user data | - SMPTE 328m time code in picture user data |
| Programme start | - Programme start at TC 00:00:00:00 | - Programme start at TC 00:00:00:00 | - Programme start at TC 00:00:00:00 |



7.3 Metadata

The format must be specified when a new customer is connected. Metadata should be delivered in XML format (see example below). Delivery via FTP, hard disk, solid-state drives or similar.

Beispiel XML:

```
<AXFRoot>
  <MAObject type="default" mdclass="MOB">
    <Meta name="MOB_TITLE" format="string" frate=""> </Meta>
    <Meta name="FTP_INGESTID" format="string" frate=""> </Meta>
    <Meta name="XML" format="string" frate=""> </Meta>
    <Meta name="SOURCEFORMAT" format="string" frate="">mpg</Meta>
    <Meta name="ZIELSYSTEM" format="string" frate="">SAW</Meta>
    <Meta name="CLIENT" format="string" frate=""> </Meta>
    <Meta name= .
    <Meta name= .
    .
    .
```



8. External network connections (VPN and FTP)

PLAZAMEDIA is connected redundantly with a speed of 1Gbit/s. A bandwidth guarantee can only be made with a QOS agreement.

8.1 VPN access

VPN access must always be negotiated from scratch and checked technically when a customer requires it. The only protocols used are IPsec (IP Security Protocol). In the case of site-to-site VPN, it is also necessary for the communication partner to have a fixed public IP address to make it technically possible to allow authentication on the basis of a combination of the IP address and a fixed password.

8.2 FTP access

FTP access is specified as follows:

- FTP access can only be activated after a data protection agreement has been signed. Passwords for the use of FTP are **only** released to authorised persons.
- The FTP server is only used for exchanging data. Data that resides on the server for longer than 10 days must be archived or deleted. Archiving is carried out after consultation.
- Each FTP account is governed by a defined disk quota.
- The file formats to be expected must be specified by the customer (protection against files that cannot be executed).
- The FTP server can only be accessed from a fixed IP address.



9. Address and contacts

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Support helpline:

Tel.: +49 89 99633 - 6000 or 6001

PLAZAMEDIA GmbH:

Chris Wieland, Director Technology +49 89 99633 - 6200

Handbuch Fernsehbetriebstechnik:

Available from the Institut für Rundfunk und Fernsehtechnik (IRT)

Funktechnische Richtlinien (FTZ):

Available from the Regulierungsbehörde für Telekommunikation und
Post and from the Institut für Rundfunk- und Fernsehtechnik

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