



PBS

TOS-21

PBS Technology & Operations

TECHNICAL OPERATING SPECIFICATIONS

Program Distribution from PBS

2010 Edition

1. SCOPE AND PURPOSE

This TOS describes standards PBS adheres to in distributing programs of consistently high technical quality over the Public Television Satellite Interconnection System (PTSIS). Other entities using the interconnection system are encouraged to adhere to these standards, but may or, may not, do so. Consult with those distributors for their specifications.

For questions related to PBS program distribution and this TOS, contact the Director, Network Operations Center at PBS.

2. VIDEO

2.1 Video Level

2.1.1 Video levels will be measured with direct digital waveform monitoring equipment calibrated to represent video levels on the final submission.

2.1.2 The GBR gamut will be hard limited (“legalized”) to the 0 to 700 millivolt range prior to transmission.

2.2 Video Image

2.2.1 The production aperture of full-screen content is defined for each field as shown:

Format	Field 1	Field 2
480i	23-262	286-525
1080i	21-560	584-1123

2.2.2 When 16:9 content is placed within a 4:3 production aperture (which is termed "letterbox") the image will fill the following lines, thus vertically centering the image:

	Field 1	Field 2
480i 16:9 Letterbox	53-232	316-495

2.2.3 The Safe Areas are:

2.2.3.1 Safe Action is the area within which all signification action must be contained. The area is 93% of the width and height of the production aperture.

Format	Production Aperture	Safe Action Area
480i	720 x 480	670 x 446
1080i	1920 x 1080	1786 x 1004

2.2.3.2 Safe Title Area is the area within which all significant titles must be contained. The area is 90% of the width and height of the production aperture.

Format	Production Aperture	Safe Title Area
480i	720 x 480	648 x 432
1080i	1920 x 1080	1728 x 972

2.2.4 The aspect ratio of all HD programming is 16:9.

2.3 Field and Frame Rate

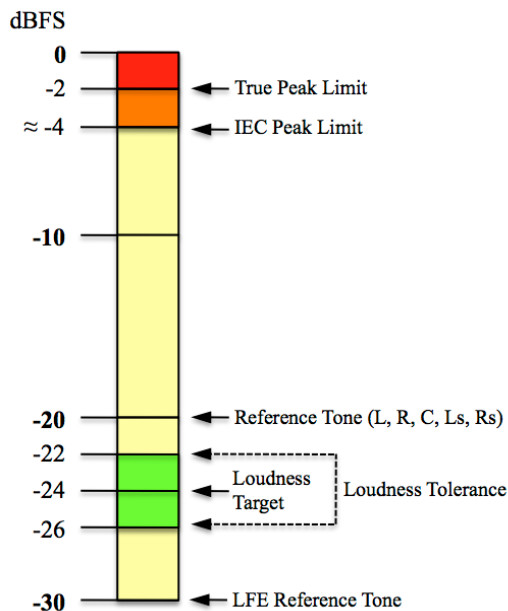
2.3.1 The field rate for both standard and high definition is 59.94... fields per second (exactly 60 multiplied by 1000/1001). The frame rate for both standard and high definition is 29.97... frames per second (exactly 30 multiplied by 1000/1001).

3. AUDIO

3.1 Audio Level

3.1.1 The operating level for reference tone and legacy analog system calibration is -20 dBFS per SMPTE RP155.

3.1.2 The average dialog and program audio level will be -24 LKFS \pm 2 dB. Excursions beyond this range will be acceptable where appropriate for context; however the normal levels for content will be within this range.



3.1.3 Programs are permitted to have audio levels that peak up to -2 dBFS during moments of dramatic impact. Programs will not exceed this level.

3.2 Audio Quality

3.2.1 The audio mix will be free of audible clipping and other distortions.

3.2.2 The audio mix will be free of obvious noise except where that noise is an intended part of the content.

3.2.3 The dialog will be intelligible under all conditions, including when the audio channels are upmixed or downmixed

3.3 Audio Phasing & Synchronization

3.3.1 Audio timing and phase will remain consistent across all channels and tracks.

3.3.2 Audio/video synchronization (lip sync) will appear to be correct during the program itself. During the program countdown, or by any in-service measurement technique adopted in the future, audio will not lead video by more than one half frame, nor will audio lag video by more than two frames. See Figure 1.

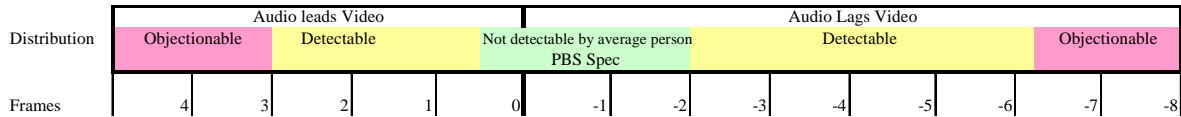


Figure 1: Audio and Video Lead/Lag Specification

3.3.3 Audio will be within two frames between services (e.g., between main and secondary services).

3.4 Audio Channel/Track Assignments

3.4.1 Standard Definition Programming Audio Service

3.4.1.1 Standard definition programming will always be transmitted with the primary audio service in stereo.

Channel/Track	Primary Audio Service Assignment
Ch 1	Left or Left Total
Ch 2	Right or Right Total

3.4.1.2 Programs may be encoded using Dolby Pro-Logic with Lt/Rt replacing the normal stereo audio on channels/tracks 1 & 2.

3.4.1.3 Standard definition programming will always be transmitted with the secondary audio service in stereo.

Channel/Track	Secondary Audio Service Assignment
Ch 1	DVI (Descriptive Video Information) or Mono
Ch 2	SAP (Secondary Language) or Mono

3.4.2 High Definition Programming Audio Service

3.4.2.1 High definition programming will always be transmitted with the primary audio service in stereo or with 5.1 channels. If the primary audio service is transmitted in stereo the table in 3.4.1.1 applies. If the primary audio service is transmitted in 5.1 channel audio the following table applies.

Channel/Track	Primary Audio Service Assignment
Ch 1	Left Front (L)
Ch 2	Right Front (R)
Ch 3	Center (C)
Ch 4	Low Frequency Effects (Lfe)
Ch 5	Left Surround (Ls)
Ch 6	Right Surround (Rs)

3.4.2.2 Programs may be encoded using Dolby Pro-Logic with Lt/Rt replacing the normal stereo audio on channels/tracks 1 & 2.

3.4.2.3 High definition programming will always be transmitted with the secondary audio service in stereo.

Channel/Track	Secondary Audio Service Assignment
Ch 1	DVI (Mono or Left), or Mono
Ch 2	SAP, DVI (Right), or Mono

4. Ancillary Information

4.1 Time

4.1.1 Where provided on specific services Time-of-Day Time Code is provided on the third audio service according to the following table.

Channel/Track	Time of Day Time Code Type
1	UTC (Universal Coordinated Time)
2	ET (Eastern Time – standard or daylight adjusted)

4.1.2 The time in Channel/Track 2 (ET) is advanced by PBS to account for encoding and transit delays such that the transmitted clock is received in the center of the continental United States at the actual correct time.

4.2 Closed Captioning

4.2.1 For High Definition submissions, CEA-708-C captions with "608 compatibility bytes" will be carried in the ancillary data space (ANC) per SMPTE 334M-2000. The captioning ANC data will be present on line 9.

4.3 Active Format Description (AFD)

4.3.1 AFD data will be encoded per SMPTE 2016-1-2009 and will be packetized per SMPTE 2016-3-2009.

4.3.2 Ancillary codes will be set per SMPTE RP 291-2009.

4.3.3 For high definition transmissions the AFD data will be present on field 1 and field 2 of line 11.

4.3.4 For standard definition transmissions the AFD data will not be present.

4.3.5 All AFD data and ancillary codes will be placed in the line after any closed captioning data.

4.3.6 For all programming that includes AFD data the data will be frame accurate, that is any AFD code change signaling a change in the image within a program will occur on the frame it references.

4.3.7 The AFD codes transmitted will be:

AFD Code (binary and decimal)	Description (per SMPTE 2016-1)
'1000' (8)	Image is full frame, with an aspect ratio that is the same as the 16:9 coded frame.
'1001' (9)	Image with a 4:3 aspect ratio as a horizontally centered pillarbox image in a 16:9 coded frame.
'1010' (10)	Image is full frame, with a 16:9 aspect ratio and with all image areas protected.
'1111' (15)	Image with a 16:9 aspect ratio and with an alternative 4:3 center in a 16:9 coded frame.