



DCL GLOBAL TECHNICAL SPECIFICATIONS

VERSION 4.1

INTRODUCTION

This specification notifies Discovery's production partners of Discovery's technical requirements and standards for program masters, graphics masters, and supplemental program audio. Production partners are responsible for reading and understanding these requirements and delivering products that meet them. In this specification, "Discovery" refers to any network owned by Discovery Communications LLC (DCL), as well as any of DCL's joint ventures. The term "production partner" refers to the production company providing a program to Discovery, whether through commission, co-production, or acquisition.

WHAT IS IN THIS SPECIFICATION?

This specification includes Discovery's technical requirements for SD, HD, and stereoscopic 3D programs. It applies to programs delivered in any of the seven television standards that Discovery accepts for program delivery.

- 1080i 59.94
- 1080i 50
- 1080p 29.97
- 1080p 25
- 1080p 23.98
- NTSC
- PAL

Production partners must refer to their contracts to determine which of these television standards Discovery requires for their program.

This specification also includes Discovery's technical requirements for the delivery of program graphics packages on LTO data tape.

This specification does not include Discovery's requirements for file based program master delivery nor for delivery of file based camera footage. Production partners can find those requirements in the "Discovery File Based Program Masters" addendum and the "Discovery File Based Footage Delivery Policy."

NEW IN VERSION 4.1

Version 4.1 of this specification includes clarifications and changes from version 4.0. These are some of the key differences.

- Clarifications and changes in the audio section around loudness levels, track assignments, dipped and undipped stems, and how to manage bleeps for profanity
- Clarification on how the program text protection area is enforced
- A simplified program leader specification for SD and HD
- Some clarifications in the LTO Graphics Master section
- Minor updates and corrections

Version 4.1 contains these changes as well as others. Production partners with questions should contact their Discovery Production Manager.

NORMATIVE AND INFORMATIVE LANGUAGE

This specification contains both normative and informative language. The specification uses normative language to state Discovery’s requirements. In this specification, the words “must” and “shall” are used to indicate that compliance is mandatory. Most of the language in this specification is normative, but the specification also uses some informative language. Words such as “should”, “may”, or any section preceded by “NOTE” indicate that a statement is informative. These parts of the document contain background information or present production partners with several options.

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SECTION ONE: VIDEO

This section of the specifications details Discovery's requirements for SD, HD, and stereoscopic 3D video. The SD subsection contains the requirements for NTSC and PAL programs. The HD subsection contains requirements for programs delivered in 1080i 59.94, 1080i 50, 1080p 29.97, 1080p 25, and 1080p 23.98. The 3D subsection contains additional requirements for programs delivered in stereoscopic 3D.

1.1 REQUIREMENTS FOR SD PROGRAMS

This subsection includes the requirements for programs delivered in NTSC and PAL.

1.1.1 REFERENCE STANDARDS FOR SD PROGRAMS

Discovery follows many common industry standards for video format and interchange. All SD programs must comply with the following industry technical standards.

- ITU-R BT.601-7 Studio Encoding Parameters of Digital Television for Standard 4:3 and Wide-screen 16:9 Aspect Ratios
- ITU-R BT.624-4 Characteristics of Systems for Monochrome and Colour Television
- SMPTE 259M-2008 SDTV Digital Signal/Data Serial Digital Interface
- SMPTE 12M-1-2008 Time and Control Code
- SMPTE RP 218:2009 Specifications for Safe Action and Safe Title Areas for Television Systems
- SMPTE 170M-2004 Composite Analog Video Signal – NTSC for Studio Applications

1.1.2 ACCEPTABLE CAMERA SYSTEMS FOR SD PROGRAMS

Production partners must use only professional-grade cameras, recorders, media and tools. At the request of the Discovery Production Manager (PM), partners must provide a production workflow for review. The Discovery PM must review and approve the production workflow before production can begin. Partners can download the Production Workflow Questionnaire from the Discovery Producer's Portal (<http://producers.discovery.com>)

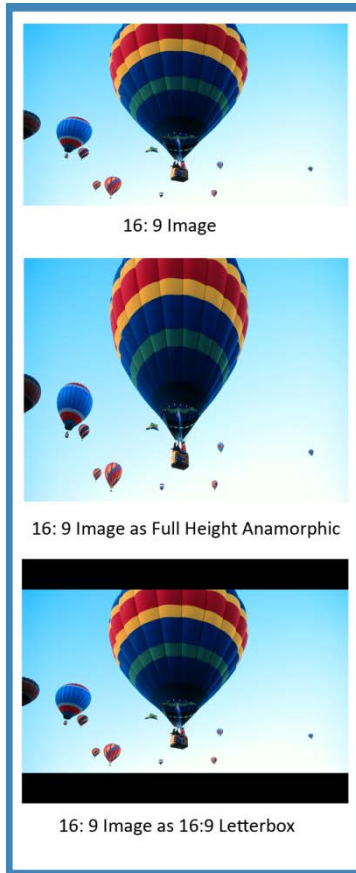
1.1.3 ACCEPTABLE MASTERING CODECS FOR SD PROGRAMS

When creating the master, production partners must only use codecs that meet the following specifications:

- The codec must use 4:2:2 or 4:4:4 sub sampling for the color difference (chroma) signals
- The video must have a minimum resolution of 720 by 480 for NTSC, 720 by 576 for PAL
- The codec must use only intra-frame compression
- The codec must have a minimum bit rate of 50 megabits per second (Mb/s) for video
- The codec must preserve audio with at least 20 bits of depth with 48 kHz sampling

These requirements apply to codecs used in nonlinear editing systems, recorders, or any other tool used to create the finished version of the program master. *Production partners may use other codecs for "offline" editing, if they use codecs meeting these requirements for their final "online" edit.* If production partners have questions about the qualifications of an editing system or codec, they should contact their Discovery Production Manager.

1.1.4 ASPECT RATIO FOR SD PROGRAMS



Production partners must deliver their programs in the aspect ratio specified by the deliverables exhibit of their contract. Discovery uses two primary aspect ratios for SD program masters: 16:9 and 4:3.

When delivering a 16:9 program master in SD the production partner must format the 16:9 video as a full height anamorphic image within the 4:3 SD frame (Figure 1). In a full height anamorphic image the 16:9 image is squeezed horizontally by 33%, distorting the image. This preserves as much of the resolution of the 16:9 image as possible while fitting it within the 4:3 frame.

Programs must not contain a mix of different aspect ratios.

If the production partner's contract requires delivery of the program as a 16:9 letterbox, the letterbox must meet the following requirements.

NTSC letterbox images must be 181 scan lines in height in each field. The top of the image must be at line 50 (field 1) and the bottom of the image must be at line 233 (field 1).

PAL letterbox images must be 216 scan lines in height in each field. The top of the image must be at line 58 (field 1) and the bottom of the image must be at line 275 (field 1).

Letterbox images must not contain partial lines of picture. The top and bottom edges of the letterbox must be full lines of picture.

Figure 1: Aspect Ratio Examples

1.1.5 WORKMANSHIP

Production partners must deliver programs that meet Discovery's standards for professional workmanship. When delivering a program on videotape, the videotape must meet the VTR manufacturer's standards for the tape format. Production partners must create master tapes using VTRs maintained in compliance with the manufacturer's instructions and accurately calibrated to the manufacturer's specifications. The physical tape stock must be of professional quality and free from damage, creases, or other defects that would cause the VTR to report a channel condition error. Discovery will not accept videotapes that contain channel condition errors. Programs must also be free of dropouts and digital blocking errors recorded into the program from other sources. Each program master must be delivered on its own videotape. If production partners deliver their program master using videotape, they must not combine multiple episodes or programs onto a single videotape.

The program must be free of errors in workmanship or craftsmanship. The program must not contain flash frames, jump cuts, or other editing errors.

1.1.6 PROGRAM LEADER

All programs must begin with a leader element with industry-standard reference signals and program identification information. Table 1.1.6 shows the program leader layout for NTSC and PAL programs.

Table 1.1.6 Program Leader for NTSC and PAL Programs

	Starting Time Code	Video Contents	Audio Contents
	NTSC 00;58;30:00 PAL 09:58:30:00	SMPTE Color Bars at 75% saturation	Reference tone at 1 kHz on all full mix channels, either stereo or surround, reference tone of 400 Hz on all other channels. For NTSC programs the reference tone must have a level of -20 dBFS. For PAL programs, the reference tone must have a level of -18 dBFS.
	NTSC 00;59;30:00 PAL 09:59:30:00	Black	Silence
	NTSC 00;59;35:00 PAL 09:59:35:00	Program Slates (including WOO slate if required)	Silence
	NTSC 00;59;50:00 PAL 09:59:50:00	Video Countdown from 10 to 3	Audible tone at each 1 second interval
	NTSC 00;59;57:02 PAL 09:59:57:02	Black	Silence
	NTSC 00;59;57:06 PAL 09:59:57:06	White	Sync Indicator Two frames of white video and 1kHz tone
	NTSC 00;59;57:08 PAL 09:59:57:08	Black	Silence
	NTSC 1;00;00:00 PAL 10:00:00:00	Program begins	Program begins

1.1.7 TIME CODE

The program's time code must be continuous, without error, and contain the appropriate flagging information in adherence to SMPTE 12M-2008.

All time code tracks (Vertical Interval Time Code (VITC), Longitudinal Time Code (LTC), and Ancillary Data Area (HANC or VANC) time code) must match exactly.

Programs delivering in NTSC must have VITC signals on lines 16 and 18 in the NTSC vertical blanking area.

Programs delivering in PAL must have VITC on lines 19 and 21 of the PAL vertical blanking area.

NTSC programs must begin at 1:00:00:00. PAL programs must begin at 10:00:00:00

If a program is too long to fit on a single videotape, the program must be continued on a second videotape. The program must begin on the second videotape at 3:00:00:00 NTSC, 13:00:00:00 PAL.

NTSC programs must use SMPTE drop frame time code.

Table 1.1.7 Time Code Requirements by Video Standard

Requirement	NTSC	PAL
Time code type	SMPTE Drop Frame	EBU
VITC Position	Lines 16 and 18	Lines 19 and 21
Program Start	1:00:00:00	10:00:00:00

1.1.8 PICTURE POSITIONING

Program video must fill the visible screen and be consistently positioned from shot to shot and scene to scene.

Table 1.1.8 gives the requirement for the video size and positioning when measured using a waveform monitor as a composite signal.

Table 1.1.8 Picture Positioning Requirements by Video Standard

Requirement	NTSC	PAL
Left edge of picture (as measured from the falling edge of the sync pulse)	Must start between 10.4 and 12 microseconds. Positioning cannot vary by more than 1.0 microseconds between shots	Must start between 11.5 and 13 microseconds. Positioning cannot vary by more than 1.0 microseconds between shots
Right Edge of picture (as measured from the falling edge of the sync pulse)	Must reach to at least 61.5 microseconds. Positioning cannot vary by more than 1.0 microseconds between shots	Must reach to at least 61.5 microseconds. Positioning cannot vary by more than 1.0 microseconds between shots
Top of picture	Must begin by line 25 (Field 1)	Must begin by line 26 (Field 1)
Bottom of picture	Must reach line 257 (Field 1)	Must reach line 305 (Field 1)

1.1.9 PROGRAM TEXT PROTECTED AREA FOR SD

Discovery has created a protected area for program text to prevent on air branding and network identifiers (bugs) from covering text elements within programs. Production partners must place all program text elements **except for program opening sequences, credits, or segment bumps** inside this protected area. Program opening sequences, credits, and segment bumpers must still comply with the title safe requirements in section 1.1.10. Moving program text elements can begin their movement outside the protected area but must be fully inside the protected area when their movement is complete.

The SD program text protected area is a single rectangular area within the SD raster. In NTSC it begins on line 68 (field one) and ends on line 238 (field one). In PAL it begins on line 79 (field one) and ends on line 282 (field one). Horizontally it begins at 14.8 microseconds after the falling edge of the sync pulse within the horizontal blanking area (72 pixels from the left screen edge) and ends at 48 microseconds after the falling edge of the sync pulse (513 pixels from the left screen edge).

Discovery provides templates that show the position and size of the Program Text Protected Area. These templates are available for download as full raster TIFF files or PNG files from the Discovery Producer's Portal (<http://producers.discovery.com>).



Figure 2: Program Text Protected Area SD - PAL

1.1.10 TITLE SAFE

Production partners must place program text elements in the text safe area defined by SMPTE RP 218 (2009). The safe area defined in RP 218 is more conservative than the current SMPTE standard (SMPTE S 2046).

For NTSC (525) signals, the safe title area is the central 80% of the picture, an area of 576 by 384 pixels beginning 72 pixels from the left edge and 47 pixels from the top of the image and ending 648 pixels from the left edge and 432 pixels from the top of the image.

For PAL (625) signals, the safe title area is the central 80% of the picture, an area of 576 by 460 pixels beginning 72 pixels from the left edge and 58 pixels from the top of the image and ending 648 pixels from the left edge and 518 pixels from the top of the image. Producers can download a TIFF file defining this area from the Discovery Producer's Portal (<http://producers.discovery.com>)

1.1.11 VIDEO LEVELS

The program's luminance levels must not exceed 100% or fall below the legal black level. NTSC programs must not have luminance levels above 100 IRE or below 7.5 IRE. PAL programs must not have luminance levels above 700 millivolts (mv) or below 0 mv.

Program chrominance levels must not exceed 120% of the maximum luminance level. Discovery measures the chrominance of SD programs as encoded composite waveforms using a flat filter. NTSC programs must not have encoded chrominance levels above 120 IRE. PAL programs must not have encoded chrominance levels above 840 mv.

All color saturation values within the program must stay within the legal gamut for a composite analog signal. A vector scope set to 75% shows the outer edge of legal gamut as the outer ring on the scope's graticule. The program's color saturation levels must never extend beyond this outer ring. The legal gamut for NTSC is different from the legal gamut for PAL. SMPTE 170M defines the legal gamut of composite NTSC signals. In NTSC some colors, most notably yellow, cyan, and green, are outside the legal gamut when saturated at 100%. ITU-R BT.624.4 defines the legal gamut of composite PAL signals.

1.1.12 STANDARDS CONVERSION AND MIXED FRAME RATE ACQUISITION

Production partners must shoot, edit, and master programs in the single frame rate specified by their program contract. If partners cannot avoid using footage with different frame rates because of archival or historic footage, then they must use only the highest quality conversion techniques and hardware to convert between the two frame rates and they must alert their Discovery Production Manager of the specific time codes where mixed frame rates have been used. If converting footage between 50 hertz (Hz) and 60 Hz, producers must use standards conversion hardware or software with motion compensation and phase correlation. Programs must not contain blurring, stuttering, de-interlacing artifacts, blended fields, or other artifacts of standards conversion.

1.1.13 GAMMA

The production partner must master the program using the standard ITU-R BT.601 gamma curves and colorimetry. This excludes masters with all other gamma curves, including log curves.

1.2 REQUIREMENTS FOR HD PROGRAMS

This subsection includes the requirements for programs delivered in the HD standards of 1080i 59.94, 1080i 50, 1080p 29.97, 1080p 25, and 1080p 23.98.

1.2.1 REFERENCE STANDARDS FOR HD PROGRAMS

Discovery follows many common industry standards for video format and interchange. All HD programs must comply with the following industry technical standards:

- ITU-R BT.709-5 Parameter values for the HDTV standards for production and international programme exchange
- SMPTE ST 292-1: 2012 1.5 Gb/s Signal/Data Serial Interface
- SMPTE ST 274: 2008 1920 × 1080 Image Sample Structure, Digital Representation and Digital Timing Reference Sequences for Multiple Picture Rates
- SMPTE 12M-1-2008 Time and Control Code
- SMPTE RP 218:2009 Specifications for Safe Action and Safe Title Areas for Television Systems

1.2.2 ACCEPTABLE CAMERA SYSTEMS FOR HD PROGRAMS

Production partners must use only professional-grade cameras, recorders, media and tools. At the request of the Discovery Production Manager (PM), partners must provide a production workflow for review. The Discovery PM must review and approve the production workflow before production can begin. Partners can download the Production Workflow Questionnaire from the Discovery Producer's Portal (<http://producers.discovery.com>)

1.2.3 UP CONVERTED MATERIALS IN HD PROGRAMS

Upconverted content (content converted from Standard Definition sources to an HD format) must not make up more than 15% of the program's content. The program must not contain more than one contiguous minute of upconverted footage.

1.2.4 ACCEPTABLE MASTERING CODECS FOR HD PROGRAMS

When creating the master, production partners must only use codecs that meet the following specifications:

- The codec must use 4:2:2 or 4:4:4 sub sampling for the color difference (chroma) signals
- The video must have a minimum resolution of 1920 by 1080
- The codec must use only intra-frame compression
- The codec must have a minimum bit rate of 100 megabits per second (Mb/s) for video
- The codec must preserve audio with at least 20 bits of depth with 48 kHz sampling

These requirements apply to codecs used in nonlinear editing systems, recorders, or any other tool used to create the finished version of the program master. *Production partners may use other codecs for "offline" editing, if they use codecs meeting the requirements for their final "online" edit.* If production partners have questions about the qualifications of an editing system or codec, they should contact their Discovery Production Manager.

1.2.5 WORKMANSHIP


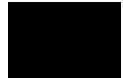





Production partners must deliver programs that meet Discovery’s standards for professional workmanship. When delivering a program on videotape, the videotape must meet the VTR manufacturer’s standards for the tape format. Production partners must create master tapes using VTRs maintained in compliance with the manufacturer’s instructions and accurately calibrated to the manufacturer’s specifications. The physical tape stock must be of professional quality and free from damage, creases, or other defects that would cause the VTR to report a channel condition error. Discovery will not accept videotapes that contain channel condition errors. Programs must also be free of dropouts and digital blocking errors recorded into the program from other sources. Each program master must be delivered on its own videotape. If production partners deliver their program master using videotape, they must not combine multiple episodes or programs onto a single videotape.

The program must be free of errors in workmanship or craftsmanship. The program must not contain flash frames, jump cuts, or other editing errors.

1.2.6 PROGRAM LEADER

All programs must begin with a leader element with industry-standard reference signals and program identification information. Table 1.2.6 shows the program leader layout for HD programs with frame rates of 23.98, 25 and 29.97 frames per second (fps).

Table 1.2.6 Program Leader for HD Programs

	Starting Time Code	Video Contents	Audio Contents
	23.98 00:58:30:00 29.97 00:58:30:00 25 09:58:30:00	SMPTE Color Bars at 75% saturation	Reference tone at 1 kHz on all full mix channels, either stereo or surround, reference tone of 400 Hz on all other channels. For NTSC programs the reference tone must have a level of -20 dBFS. For PAL programs, the reference tone must have a level of -18 dBFS.
	23.98 00:59:30:00 29.97 00:59:30:00 25 09:59:30:00	Black	Silence
	23.98 00:59:35:00 29.97 00:59:35:00 25 09:59:35:00	Program Slates, including WOO slate if required	Silence
	23.98 00:59:50:00 29.97 00:59:50:00 25 09:59:50:00	Video Countdown from 10 to 3	Audible tone at each 1 second interval
	23.98 00:59:57:02 29.97 00:59:57:02 25 09:59:57:02	Black	Silence
	23.98 00:59:57:06 29.97 00:59:57:06 25 09:59:57:06	White	Sync Indicator Two frames of white video and 1khz tone
	23.98 00:59:57:08 29.97 00:59:57:08 25 09:59:57:08	Black	Silence
	23.98 1:00:00:00 29.97 1:00:00:00 25 10:00:00:00	Program begins	Program begins

1.2.7 TIME CODE

The program's time code must be continuous, without error, and contain the appropriate flagging information in adherence to SMPTE 12M-2008.

All time code tracks (Vertical Interval Time Code (VITC), Longitudinal Time Code (LTC), and Ancillary Data Area (HANC or VANC) time code) must match exactly.

23.98 and 29.97 frames per second (fps) programs must begin at 1:00:00:00. 25 fps programs must begin at 10:00:00:00

If a program is too long to fit on a single tape, the program must be continued on a second tape. The program must begin on the second tape at 3:00:00:00 (29.97, 23.98 fps), or 13:00:00:00 (25 fps).

29.97 fps programs must use SMPTE drop frame time code.

Table 1.2.7 Time Code Requirements by Video Standard

Requirement	29.97 fps	25 fps	23.98 fps
Time code type	SMPTE Drop Frame	EBU	SMPTE Non Drop Frame
Program Start	1:00:00:00	10:00:00:00	1:00:00:00

1.2.8 PICTURE POSITIONING

Program video must fill the visible screen and be consistently positioned from shot to shot and scene to scene.

Table 1.2.8 gives the requirement for the video size and positioning when measured using a waveform monitor as a component digital signal with SAV and EAV pulses visible.

Table 1.2.8 Picture Positioning Requirements by Video Standard

Requirement	29.97 fps	25 fps	23.98 fps
Left edge of picture (as measured from the SAV pulse)	Must begin no more than 1 microsecond after the SAV pulse	Must begin no more than 1 microsecond after the SAV pulse	Must begin no more than 1 microsecond after the SAV pulse
Right Edge of picture (as measured from the SAV pulse)	Must reach to 25 microseconds after the SAV pulse	Must reach to 25 microseconds after the SAV pulse	Must reach to 25 microseconds after the SAV pulse
Top of picture	Must begin by line 31 (field 1)	Must begin by line 31 (field 1)	Must begin by line 62
Bottom of picture	Must reach line 550 (field 1)	Must reach line 550 (field 1)	Must reach line 1101

1.2.9 PROGRAM TEXT PROTECTED AREA FOR HD

Discovery has created a protected area for program text to prevent on air branding and network identifiers (bugs) from covering text elements in programs. Production partners must place all program text elements **except for program opening sequences, credits, or segment bumps** inside this protected area. Program opening sequences, credits, and segment bumpers must still comply with the title safe requirements in section 1.2.10. Moving program text elements can begin their movement outside of the protected area but must be fully inside the protected area when their movement is complete.

The HD program text protected area is a single rectangular area inside the HD raster. It begins on line 100 (field one) and ends on line 506 (field one). Horizontally it begins at 2.4 microseconds after the SAV pulse (192 pixels from the left screen edge) within the horizontal blanking area and ends at 18.6 microseconds (1389 pixels from the left screen edge).

Discovery provides templates showing the Program Text Protected Area. These templates are available for download as full raster TIFF files from the Discovery Producer's Portal (<http://producers.discovery.com>)

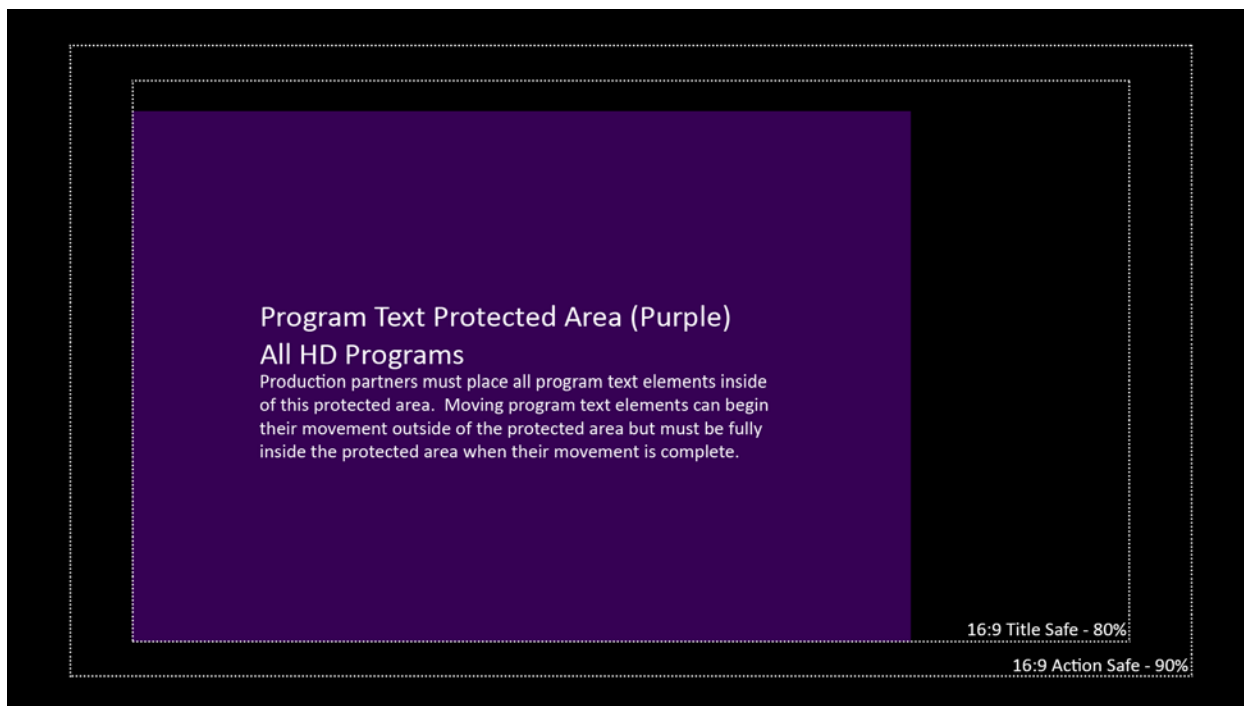


Figure 3: Program Text Protected Area for HD

1.2.10 TITLE SAFE

Production partners must place program text elements within the text safe area defined in SMPTE RP 218 (2009). The safe area defined in RP 218 is more conservative than the current SMPTE standard (SMPTE S 2046).

For HD (all 1920x1080) signals, the safe title area is the central 80% of the picture, an area of 1536 by 864 pixels beginning 192 pixels from the left edge and 108 pixels from the top of the image and ending 1728 pixels from the left edge and 972 pixels from the top of the image. Producers can download a TIFF file defining this area from the Discovery Producer's Portal (<http://producers.discovery.com>)

1.2.11 VIDEO LEVELS

HD programs must not have luminance levels above 700 millivolts (mv) or below 0 mv.

The program's color difference signals (R-Y, B-Y) must not rise above 700 mv or fall below 0 mv when measured with a 350 millivolt offset.

1.2.12 STANDARDS CONVERSION AND MIXED FRAME RATE ACQUISITION

Production partners must shoot, edit, and master programs in the single frame rate specified by their program contract. If partners cannot avoid using footage with different frame rates because of archival or historic footage, then they must use only the highest quality conversion techniques and hardware to convert between the two frame rates and they must alert their Discovery Production Manager of the specific time codes where mixed frame rates have been used. If converting footage between 50 hertz (Hz) and 60 Hz, producers must use standards conversion hardware or software with motion compensation and phase correlation. Programs must not contain blurring, stuttering, de-interlacing artifacts, blended fields, or other artifacts of standards conversion.

1.2.13 GAMMA

The production partner must master the program using the standard ITU-R BT.709 gamma curves and colorimetry. This excludes masters with all other gamma curves, including log curves.

1.3 REQUIREMENTS FOR 3D HD PROGRAMS

This subsection details the additional requirements for programs delivering in stereoscopic 3D. 3D programs must also follow the specifications in Section 1.2. This 3D subsection only includes specifications that are unique to 3D content.

1.3.1 DELIVERY FORMATS FOR 3D PROGRAMS

Production partners may choose to deliver 3D masters in any of the following formats:

TWO DPX FILE SEQUENCES, one containing the left eye view and the other containing the right eye view. DPX files must adhere to SMPTE 268M "File Format for Digital Moving-Picture Exchange (DPX), Version 2.0." DPX files must have the following characteristics-

- Image Size: 1920 x 1080
- Colorimetric Information: ITU-BT709-4
- Bit Depth: 10 bits (integer)
- Byte order: Big Endian
- Time code: Valid SMPTE time code for each frame
- Pixel Aspect Ratio: 1:1 (square)
- Files will be named using the Discovery Program Asset ID (PAID), using the following pattern
- 123456_123_12_123_EE_XXXXXX where EE is the eye view indicator (LE for left eye, RE or right eye) and XXXXXX is the incremental file number of the frame, beginning with 000000
- The deliverables section of the DCL Program Contract lists the PAID number for the program. The DCL Production Manager can address any questions about PAID number assignment.
- The full sequence for each eye view will be in a separate folder, with folder named using the PAID and "LE" or "RE" to designate the eye view.

DPX files must be delivered on a drive formatted as a single EXFAT or NTFS volume and with an IEEE1394 (800) interface. Drives must be delivered in protective containers that contain the drive and all relevant power cords and device connection cords. An MD5 checksum must be run on each of the media folders before they are copied onto the drive. Once the media folders are copied to the drive, a new MD5 checksum analysis must be run to verify the copy. The checksum results file must remain on the drive. The checksum file must indicate the MD5 checksum value for each file in the folder and be in the .MD5 format. The checksum summary files must be placed in the root of the drive volume.

When the production partner delivers a program using the DPX file delivery option they must encode the audio as Broadcast WAV files. The WAV files must be placed in an AUDIO folder on the drive containing the DPX image sequences. The Broadcast WAV files must adhere to the specifications and naming conventions laid out in section 2.8 of this document.

OR

TWO HDCAM SR MASTER TAPES, one containing the left eye view and the other containing the right eye view. Master tapes must meet manufacturer's standard for tape format interchange. Master tapes must be HDCAM SR,

at the 1080 interlace 59.94 Hz line rate or 1080 Progressive Segmented 23.98 Hz line rate, recorded in 4:2:2 mode. All tapes must be recorded on VTRs that have been maintained in compliance with the manufacturer's instructions and have been accurately calibrated per the manufacturer's specifications. Tapes must be free of dropouts, channel condition errors, and physical tape defects. The tape labeling must clearly reflect which eye view is included on the tape. The tape and the tape case must be marked with a large "LE" for the left eye view and a large "RE" for the right eye view.

OR

ONE HDCAM SR DUAL STREAM MASTER TAPE containing both the left eye and right eye views. The left eye view must be stream one on the master tape and the right eye view must be stream two. Master tapes must meet manufacturer's standard for tape format interchange. Master tapes must be HDCAM SR, at the 1080 interlace 59.94 Hz line rate or 1080 Progressive Segmented 23.98 Hz line rate, recorded in 4:2:2 X 2 mode. The tape labeling must clearly reflect that the tape is a dual stream master.

1.3.2 BASIC REQUIREMENTS FOR 3D PROGRAM VIDEO

All acquisition and recording systems must maintain the full frame resolution throughout the production and mastering process. Systems that record "frame compatible" signals with reduced resolution may not be used.

1.3.3 ACCEPTABLE CAMERA SYSTEMS FOR 3D PROGRAMS

Production partners must use only professional-grade cameras, recorders, rigs, media and tools. Partners must give their production workflows to the Discovery Production Manager (PM) for review. The Discovery PM must approve the production workflow before production can begin. Partners can download the 3D Production Workflow Questionnaire from the Discovery Producer's Portal (<http://producers.discovery.com>)

1.3.4 ACCEPTABLE MASTERING CODECS FOR 3D PROGRAMS

When creating the master, production partners must only use codecs that meet the following specifications:

- The codec must use 4:2:2 or 4:4:4 sub sampling for the color difference (chroma) signals
- The video must have a minimum resolution of 1920 by 1080 for each eye view
- The codec must use only intra-frame compression
- The codec must have a minimum bit rate of 100 megabits per second (Mb/s) for video
- The codec must preserve audio with at least 20 bits of depth with 48 kHz sampling

These requirements apply to codecs used in nonlinear editing systems, recorders, or any other tool used to create the finished version of the program master. *Production partners may use other codecs for "offline" editing, if they use codecs meeting the requirements for their final "online" edit.* If production partners have questions about the qualifications of an editing system or codec, they should contact their Discovery Production Manager.

1.3.5 VIEW ALIGNMENT

The left eye and right eye views must be properly aligned in the vertical axis with minimal vertical offset. The vertical misalignment of the two eye views must not exceed three (3) lines at picture center or seven (7) lines at the picture edges. The two views may not be more than a quarter of a degree out of rotational alignment at any point in the program. The focal length and focus of both views must be aligned, free of any differences in perceived clarity or image size between the eye views.

1.3.6 COLORIMETRIC ALIGNMENT

The colorimetry of the two eye views must be properly aligned throughout the program, with no perceivable difference in picture gamma, hue, luminance, or chrominance between the two views.

1.3.7 VIEW DISPARITY

The disparity between the left and right eye views must not go beyond the point of clear binocular single vision or cause viewing discomfort for the average viewer.

NOTE: There is not currently an established standard for stereoscopic viewer comfort in the television viewing environment. While professionals in 3D production and optometry continue research in this area, we require that DCL's producers use their best judgment and produce comfortable stereo (3D) images for the television screen. Comfort for television viewing differs from cinema viewing, as screen size, viewing distance and lighting conditions are all different in the typical home television viewing environment. Viewing conditions in the post production environment should reflect likely viewing conditions in the home, with display sizes ranging from 40 inches to 65 inches (diagonal) and viewing distances of between four and five screen heights. Producers should avoid excessive parallax values that exceed the intraocular distance of the average viewer (67 millimeters) when viewed on larger displays. Images with excessive negative parallax (objects placed too far in front of the screen plane) should also be avoided. Viewers must be able to comfortably fuse (see as a single object) all the objects in the image without eye strain.

1.3.8 VERGENCE

The program must not contain sudden and significant shifts in the vergence position. If a transition between shots requires a significant shift in the perceived screen plane, a vergence dissolve transition (sometimes known as a hand-off) must be used.

NOTE: While research continues in this area, it is known that large shifts in vergence (changing the focusing from object that appears well behind the screen plane to one well in front or vice versa) result in eye strain and viewer discomfort. Again, producers should use their best judgment and strive for a comfortable image over the course of the program.

1.3.9 INCLUSION OF 2D CONTENT

The program must be composed of at least 85 percent natively acquired 3D footage or 2D footage converted using a method approved in writing by Discovery. When 2D stock footage is used in the program it must be incorporated as a flat element (the left eye and right eye views containing an identical image). 2D footage must not compose more than 15 percent of the program and may not make up more than one contiguous minute of the program. The Discovery Production Manager must approve any exception to this requirement in advance.

1.3.10 TEXT PLACEMENT

The text elements of both the left eye and right eye view must adhere to Discovery's standard for HD title safe. The text elements must be placed at a depth position appropriate to the background. While the placement of these text elements is a creative choice, the text elements must not contain false depth cues. A false depth cue is created when the text is superimposed on top of objects in the video image while having depth/parallax values that would place the text behind those objects in relative Z space.

1.3.11 STEREO WINDOW VIOLATIONS

The program must be free of stereo window violations. Objects that are central to the viewer's focus may not break the right and left edges of the screen when placed in negative parallax.

1.3.12 TIME CODE

The time code of the left and right eye master tapes or file sequences must match exactly. 3D programs must also follow the time code requirements found in Section 1.2.7.

SECTION TWO: AUDIO

This section of the specifications details Discovery's requirements and standards for the audio content of the program master, as well as any supplemental audio deliverables.

2.1 AUDIO PHASE

Stereo channels within the program master must be in coherent phase with each other. When the left and right channels of a stereo pair are summed to mono there must be no phase cancellation or discernible change in fidelity. If production partners use stereo-enhancement software or hardware, they must use it to enhance the stereo experience without compromising mono playback in any way.

2.2 AUDIO SYNCHRONIZATION WITH PICTURE

The audio content of the program master must maintain proper synchronization with the video content throughout the full length of the program. There must be no perceptible lip sync errors or other signs that the audio content is out of synchronization with the video content. The audio content must not be more than 20 milliseconds ahead of the video content or more than 60 milliseconds behind the video content.

2.3 SYNCHRONIZATION BETWEEN AUDIO TRACKS

The audio tracks making up the program master must maintain proper synchronization with each other throughout the full length of the program. If there is an offset between any sets of tracks, it must not exceed 15 milliseconds (half a frame).

2.4 AUDIO LEVELS

Discovery evaluates audio levels based on two measurements: loudness and true peak. The program's audio content must meet the following requirements for audio levels.

2.4.1 LOUDNESS LEVELS

The full mix tracks of the program must have an average loudness level of -24 LKFS/LUFS (plus or minus one dB), as measured using a meter compliant with ITU-R BS.1770-3. If the program has multiple segments, each segment must have an average loudness level of -24 LKFS/LUFS (plus or minus one dB.)

The program must also have consistent short term loudness levels. Short term loudness levels must not vary more than four dB above or below the average loudness level of the program or program segment.

Short term loudness levels are derived using a continuous sliding window three seconds in duration, as specified in EBU Tech 3341. The short term loudness level for each second is derived by calculating the average loudness level of the past three seconds, as measured using a meter compliant with ITU-R BS.1770-3.

Discovery evaluates short term loudness level measurements in context. If there is a long passage of quiet natural background sound without dialogue, the short term loudness measurement of that passage will and should be lower than passages that contain dialogue as an anchor element.

Discovery does not use “dialogue intelligent” meters when evaluating the loudness levels of programs. While speech remains the “anchor element” of Discovery programming (see 2.5.1), Discovery will measure the loudness level of the entire program, not only the sections containing speech.

2.4.2 PEAK LEVELS

The peak audio levels on any track in a program must never rise above -2 dBFS, when measured using a True Peak meter compliant with ITU-R BS.1770-3. *Production partners should only use audio peak levels above -6 dBFS in small areas of the program and only when needed for impact or emphasis in the audio mix. While digital delivery of television signals allows for high peak levels, older analog systems cannot allow peak levels above -10 dBFS. These older analog systems may use audio limiting to lower peak levels. To avoid the impact of excessive peak limiting production partners should use audio with high peak levels sparingly.*

2.5 REQUIREMENTS FOR AUDIO MIXING

Discovery requires program audio mixes to provide a high quality experience for the networks’ viewers. To help meet that requirement, Discovery’s production partners must create audio mixes that meet the following requirements.

2.5.1 SPEECH IS THE ANCHOR ELEMENT

Production partners must create programs with audio mixes that allow Discovery’s viewers to clearly hear and understand the dialogue, narration, and other spoken language. Music and effects in a program must not drown out spoken language or make it difficult for viewers to understand.

2.5.2 DYNAMIC RANGE

Production partners must mix programs with a dynamic range that provides a comfortable experience for Discovery’s viewers. Production partners must not use excessive dynamic compression to create programs with dense and fatiguing audio mixes. Production partners must also avoid creating mixes with excessive dynamic range or with an inconsistent dynamic range.

2.5.3 WORKMANSHIP

Production partners must create the audio content using professional tools and professional workmanship. Audio must not contain noise, dropouts, or distortion. The audio must be free of artifacts caused by excessive dynamic compression or brick wall limiting.

2.6 AUDIO TRACK CONFIGURATION

Discovery requires a common track configuration for audio tracks on program masters regardless of the format used to deliver the master. If the production partner's contract requires them to deliver a program master using a format that cannot contain 12 audio tracks, the production partner must deliver **ALL TRACKS** as broadcast wave files in addition to the tracks delivered on the tape. This document lists the requirements for broadcast wave files in Section 2.8. Figure 4 shows the audio track configuration for program masters and for three possible delivery formats. Production Partners must deliver program masters using the format required by the deliverables exhibit of their contract.

Figure 4: Audio Track Configuration for 12 Channel, 8 Channel, and 4 Channel Videotape Delivery.

	12 Channel Videotape Format	8 Channel Videotape Format	4 Channel Videotape Format
Audio Tracks Delivered on the Master Tape	1 Full Mix L	1 Full Mix L	1 Full Mix L
	2 Full Mix R	2 Full Mix R	2 Full Mix R
	3 Mix minus Narration, Undipped L	3 Mix minus Narration, Undipped L	3 Mix minus Narration, Undipped L
	4 Mix minus Narration, Undipped R	4 Mix minus Narration, Undipped R	4 Mix minus Narration, Undipped R
	5 Music, Undipped L	5 Music, Undipped L	
	6 Music, Undipped R	6 Music, Undipped R	
	7 Effects, Undipped L	7 Effects, Undipped L	
	8 Effects, Undipped R	8 Effects, Undipped R	
	9 Music and Effects Undipped L		
	10 Music and Effects Undipped R		
	11 SOT/Dialogue, Undipped Mono		
	12 Narration (or Laugh Track) Mono		
Audio Tracks Delivered as BWA V Files on Data DVD	NO BWA VS NEEDED FOR 12 CHANNEL VIDEOTAPE FORMAT	Full Mix Stereo	Full Mix Stereo
		Mix minus Narration, Undipped Stereo	Mix minus Narration, Undipped Stereo
		Music, Undipped Stereo	Music, Undipped Stereo
		Effects, Undipped Stereo	Effects, Undipped Stereo
		Music and Effects Undipped Stereo	Music and Effects Undipped Stereo
		SOT/Dialogue, Undipped Mono	SOT/Dialogue, Undipped Mono
		Narration (or Laugh Track) Mono	Narration (or Laugh Track) Mono

2.6.1 FULL MIX AUDIO FOR 5.1 SURROUND SOUND

If a production partner's contract requires them to deliver a full mix in 5.1 surround sound the production partner must deliver that mix as a single interleaved broadcast wave file. Production partners delivering a 5.1 full mix must also deliver a stereo full mix. Discovery does not require producers to deliver stereo mixes that use Dolby Pro Logic or any other type of encoded surround audio. The 5.1 full mix must use the L,R,C,S,Ls,Rs channel order.

2.7 AUDIO TRACK CONTENTS

Discovery's audio deliverables include a full program mix and six different audio stems. These audio stems allow Discovery to modify the program audio, creating new mixes in other languages for distribution around the world. This section defines the contents of each of the audio stems. While the stem definitions address many of the common questions about how audio elements are grouped into stems, there will always be exceptions. When questions come up production partners should use professional judgment to group elements into stems, remembering that the main purpose of all stems is to create new program audio in different languages.

- **Narration:** Narration includes all voiceover recordings provided by the program's narrator or host. If the program has a host who appears on camera, only the host's **off camera** voiceover should be included in the narration stem. The narration stem also includes any voiceover language translation. Scripted series with laugh tracks must place laugh track audio on the narration stem.
- **SOT/Dialogue:** This stem includes any on-camera dialogue, including on-camera dialogue from a program's host. The stem also includes any interviews, even when the interview subject is off camera. In reality-style programs the dialogue may be inseparable from background sound and ambiance recorded in the field. If audio recorded in the field contains dialogue that drives the program's story, that audio should be included in the dialogue stem. If not, it should be included as part of the effects stem.
- **Effects:** The effects stem includes all effects added in post production, along with field recordings not included in the SOT/Dialogue stem. Background ambiance without spoken language should always be included in the effects stem. The effects stem should also include background dialogue from B-roll. If dialogue is not driving the program story or is not intended to be understood it should be included in the effects stem. The effects stem should also include any re-created ambiance or foley effects (with the exception of laugh tracks).
- **Music:** The music stem includes the program's musical soundtrack and any tonal sound effects (drum rolls, hits, etc) used to accentuate the soundtrack.
- **Mix minus Narration:** This stem includes all the audio elements of the full mix except for the program's narration.
- **Music and Effects:** This stem includes all the audio elements of the full mix except for the narration and dialogue. This stem should be free of any spoken language used to drive the program story.

2.7.1 AUDIO DIPS

All audio stems must be "undipped." Discovery uses the term "undipped" to describe audio stems that do not change level in response to the other stems that make up the program's mix. Some audio consoles refer to this as "pre fader level."

Undipped stems are essential to language customization work, as each language has its own timing and efficiency. As an example: narration copy created in English will take longer to say in Spanish. If the audio stems dip in response to the timing of the English narration then Discovery must remove those dips in the stems when recreating the program in Spanish, or in any other language.

Undipped mix minus narration stems do not change level in response to the program narration. They continue at the same level as if no narration was present. Undipped music and effects stems do not change level in response to program narration or to program dialogue. They continue at the same level as if neither narration nor dialogue were present. Figure 5 illustrates this concept.

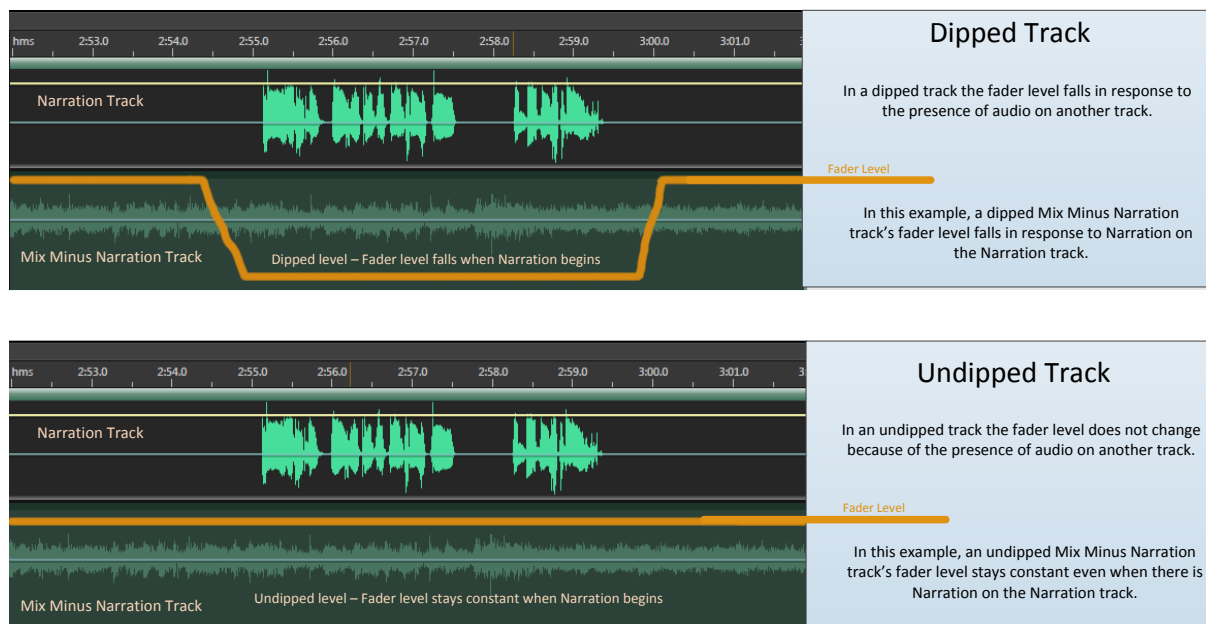


Figure 5: Dipped and Undipped Audio Tracks

2.7.2 PROFANITY, CONFIDENTIAL INFORMATION, AND BLEEPS ON AUDIO STEMS

When production partners bleep or mute dialogue on the full mix to cover profanity they must preserve the original dialogue on the audio stems. **Audio stems must not be bleeped or muted to cover profanity. This includes the Mix Minus Narration and Music and Effects stems.** Production partners may still use bleeps or muting on all tracks (including audio stems) to protect confidential sources or personal information.

2.8 BROADCAST WAVE FILES

Some program delivery formats require production partners to deliver tracks as broadcast wave files. The production partner must provide a separate file for each track type required by the "Program Deliverables" section of their contract. Tracks must be grouped together by stem type. For example, the two tracks of a stereo Effects stem must be grouped together into a single stereo broadcast wave file.

2.8.1 BROADCAST WAVE FILE SPECIFICATIONS

Broadcast Wave files must be 24 bits in depth, with a sample rate of 48 kHz. Mono files must be properly gain compensated by +3dB: that is, a narration track, metering -20 dbFS when panned to center on a stereo meter, would have a mono equivalent of -17 dBFS. This will result in mono files that produce audio levels identical to their stereo counterparts.

Wave files must contain reference tone and the alignment sync indicator. The tone must align in time with its videotape bars/tone equivalent, usually 1:30 before program start, or 00:58:30:00 (09:58:30:00 for 1080i 50, 1080p 25 and PAL programs). Wave files must also include the sync indicator (a two frame burst of 1k tone) at 00:59:57:06 (09:59:57:06 for 1080i 50, 1080p 25, and PAL programs).

2.8.2 BROADCAST WAVE FILE NAMING CONVENTION

Production partners must name broadcast wave files using the Program Identification Number along with a brief track descriptor component and an ISO 639 language descriptor code for tracks that contain spoken language. The Program Identification number is a combination of the program's Property ID and Episode Number. The episode number is a three-digit number indicating the sequence of episodes within a series. The combination of these two numbers becomes the Program Identification Number. Discovery assigns every program a Property ID and an Episode Number. The Discovery producer or production manager will provide these identification numbers to the production partner. Table 2.8.2A illustrates the naming convention for supplemental audio files. Table 2.8.2B lists some of the common ISO 639 descriptor tags.

Table 2.8.2A Supplemental Audio File Naming Conventions

Track Type	Track Descriptor	Language Descriptors Needed?	Example File Name
Full Mix (Stereo)	MIX	Yes	123456_123_MIX_ENG.WAV
Full Mix (5.1)	51MIX	Yes	123456_123_51MIX_ENG.WAV
Mix Minus Narration	MINUS	Yes	123456_123_MINUS_ENG.WAV
Music	MU	No	123456_123_MU.WAV
Effects	FXST	No	123456_123_FXST.WAV
Music and Effects	MnE	No	123456_123_MnE.WAV
On Camera Dialogue	OCD	Yes	123456_123_OCD_ENG.WAV
Narration	NAR	Yes	123456_123_NAR_ENG.WAV

Table 2.8.2B ISO 639 Alpha Tags for Some Common Languages

Language	ISO 639 Alpha 3 Code	Language	ISO 639 Alpha 3 Code
English	ENG	Spanish	SPA
French	FRE	German	GER

SECTION THREE: GRAPHICS ELEMENTS

This section of the technical specifications details the requirements for graphics masters. The program contract may require the production partner to deliver a graphics master along with the program master. The graphics master contains all graphic elements used to create a program. The purpose of the graphics master is to provide Discovery with all of the elements needed to recreate the graphic elements of the program in multiple languages.

3.1 DELIVERING AFTER EFFECTS PROJECTS

If the production partner created the graphics elements using Adobe After Effects then the production partner may deliver an After Effects project for each element. If the graphics elements were not created in Adobe After Effects then the production partner must use the format specified in section 3.2.

3.1.1 PROJECT FORMAT SPECIFICATIONS

After Effects projects must have a resolution of 1920 x 1080 (square pixel) and a frame rate that matches the frame rate of the program. Projects must have a color depth of 8 bits per channel and use the ITU-R709 colorimetry for their working space. Projects must use frame rates that match the frame rate of the program. Project audio must have a sample rate of 48 KHz. The project must be created using Adobe After Effects CS6. Any projects created using newer versions of Adobe After Effects must be saved as a CS6 compatible project.

3.1.2 RENDERING PROJECT FILES

Production partners must divide the layers within any After Effects projects into two groups: editable text layers and background elements. Editable text layers are the text that Discovery can reasonably expect to change during international language customization or creative customization of the program. Editable text layers must be maintained as separate layers in the After Effects project. Editable text layers may not have characteristics that are based on After Effects 'Expression' properties. All layers that contain editable text must be independent from other layers. Background elements are the underlying video, banners, and other elements that make up the backdrop for the editable text. Discovery requires all of these layers for its international customization process.

The production partner must provide two versions of each composition within the project. The first version must contain all of the elements layers and sources used to create all of the elements within the project. The production partner must also create a second composition within the After Effects project that provides all background elements as pre-rendered video layers. The second composition must also contain all of the editable text layers.

This includes:

- Rendering out all back plates
- Rendering out any elements that include third party plug-ins
- Rendering out alpha channel or holdback matte information for layers that occlude any editable text layer

Pre-rendering must be done by using the After Effects <COMPOSITION – PRE-RENDER> command. Pre-renders must be rendered using the Avid DnX codec at the correct bit rate for the frame rate of the composition (see 3.2) or the Animation codec, contained within a Quicktime (MOV) wrapper. The DnX 145 codec or Animation codec must be selected when setting up the options for the After Effects Output Module within the render queue. Pre-renders may be rendered as progressive video or as interlaced video with upper field first dominance. Pre-renders must be rendered at a resolution of 1920 x 1080.

3.1.3 COMPILING AND COLLECTING PROJECT FILES

After Effects projects must be “collected” and pre-rendered prior for delivery to Discovery. All files used in a project must be consolidated to the delivery drive using the After Effects <FILE – COLLECT FILES> command. The <REDUCE PROJECT> option must be selected. This option will limit the collection to the files used within the project’s compositions. The collection process gathers any media elements imported in the After Effects project into a <(FOOTAGE)> folder. The collection report generated by After Effects must also be included. This report details all of the resources used by the project. This report must include a list of all third party plug-ins used in the creation of the project. Discovery’s verification process for graphics masters checks for the presence of the <(FOOTAGE)> folder and the collection report for all After Effects projects. Discovery will reject graphics masters that have After Effects projects without these elements.

3.1.4 FONT USAGE

The collection report provided with the project must list all fonts that were used in the project. Discovery cannot accept delivery of font files.

3.1.5 PROJECT ORGANIZATION AND LABELING

All compositions within an After Effects project file must be clearly named. The composition name must include the PropertyID of the program or series as well as a brief description of the composition’s purpose. File names cannot exceed 50 characters in length. As an example: a textless version of the project file for the program opening sequence for program 123456 would be named <123456_TEXTLESS_OPEN.AEP>.

All layers within a composition must use the following naming convention:

- Rendered background layers must have a name that begins with BKGD followed by a brief description
- Any supplemental layers, such as holdback mattes, must be clearly named to indicate their function in the project.

All compositions within a project must use the following naming convention:

- Compositions that contain only the text elements and pre-rendered video layers must have a name that begins with PRDR followed by a brief description
- Compositions that contain the full set of layers and effects must have a name that begins with FULL

3.2 MOVING VIDEO ELEMENTS THAT ARE NOT AFTER EFFECTS PROJECTS

Graphics elements that contain moving video must be delivered as a single video layer. Multilayer elements must be flattened into a single layer, excluding any layers that contain text. Moving video element files must be given a descriptive name that describes their purpose. The single layer video file must adhere to the following parameters:

- Resolution of 1920 x 1080
- Field Dominance set to “upper” for files containing interlaced video
- Frame rate that matches the frame rate of the program
- Codecs: Production Partners must use the DnX codec or the Quicktime Animation codec to encode the video essence of the file. Production Partners may only use versions V2.3.4 and higher of the DnX codec.
- Bit Rate: When using the DnX codec the file must have a bit rate appropriate to its frame rate and the DnX standard.
 - 1080p 23.976: 115 megabits per second (Mb/s)
 - 1080p 25: 120 Mb/s
 - 1080i 25 (50): 120 Mb/s
 - 1080i 29.97 (59.94): 145 Mb/s
- Files encoded using the Animation codec must have spatial resolution set to 50.
- Bit Depth: The file must have a bit depth of eight (8) bits.
- Alpha Channel: Yes, if applicable
- Gamma: The file must use the ITU-R BT 709-4 gamma and color space.
- Aspect ratio of 16:9 full frame, pixel aspect ratio set to 1:1 (square)

3.3 STILL IMAGES

The production partner must deliver still images as uncompressed TIFF files in 8 bit per channel RGB mode. The files must include embedded alpha channel information if it is available. Still image files must be given a descriptive name that describes their purpose. All files must have a .TIF extension.

3.4 DELIVERY USING LTO-5 DATA TAPE AND LTFS

Production partners must deliver graphics masters on LTO-5 data tapes formatted using the Linear Tape File System (LTFS). LTFS is an open file system that allows data written on LTO-5 tapes to be read and written by multiple computer operating systems using LTO-5 drives from multiple manufacturers. **THE NETWORK WILL NOT ACCEPT LTO TAPES FORMATTED USING OTHER FILE SYSTEMS.** The network will not accept graphics masters on other types of media.

The production partner must deliver the LTO-5 data tapes to Discovery in the tape’s original protective case. Tapes must be packed and shipped in protective containers that prevent damage to the tape during shipping.

3.4.1 FILE TYPES ALLOWED ON LTO GRAPHICS MASTERS

Discovery only accepts the following file types on graphics masters.

- QuickTime videos with a .MOV extension
- After Effects projects with a .AEP extension
- TIFF stills with .TIF extension
- Report files with a .TXT extension

Discovery will reject LTOs that contain other file types.

3.4.2 DESCRIPTIVE FILE NAMES FOR GRAPHICS FILES

Production partners must name graphics files in a way that describes their purpose and ties them either to the entire series or a specific episode. If a graphic is used in multiple episodes within a series its file name must begin with the series Property ID. If a graphic is used in only a single episode its file name must begin with the series Property ID followed by an underscore and the three digit episode number. Figure 6 shows examples of file names.

3.4.3 PHYSICAL LABELS FOR LTO TAPES

Production partners must label the LTO-5 data tapes and their cases. The production partner must place the label on the front of the tape cartridge, not on the top or the sides. The label must include the following information:

- Property ID
- Originating network
- Program/Series Title (contracted & final)
- Video Standard: 1080p 23.98 / 1080p 25 / 1080i 50 / 1080i 59.94
- Production company name
- Date created

Production partners can download label templates for LTO masters from the Discovery Producer's Portal (<http://producers.discovery.com>).

3.4.4 LTFS VOLUME NAME

The name of the LTFS volume on the LTO-5 tape must be the program's property ID followed by the suffix `_GFX`. The property ID is a six digit number assigned to the program or series by the network. To avoid causing problems with the file system in different operating systems the volume name must use the underscore character rather than the period to separate the different sections of the volume name. The volume name should look like this example: `<123456_GFX>`.

The LTO-5 tape must be in its native formatted capacity (1.5 TB). Data compression on the LTO tape is not acceptable.

3.4.5 DATA VERIFICATION AND CHECKSUMS

Production partners must verify that all data copied to the LTO-5 tape is an exact copy of the original source. To verify exact copies the production partner must conduct an MD5 checksum process comparing every file on the LTO-5 tape against the original source material. The MD5 checksum process uses a mathematical algorithm to generate a unique 32 character value for each file. That 32 character value is called the "checksum value" for the file. If any copy of a file is not an exact bit for bit copy of the original then running the MD5 checksum process will produce a different checksum value, indicating that the contents of the file has changed.

A text file containing the original MD5 checksum value must be included for every file on the tape. The checksum data for each primary folder on the tape must be grouped into a single text file for each of those folders. This checksum file must be in a plain text format and include the checksum value of each file listed next to the name of the file. The folder structure of the Graphics Master LTO is described in more detail in Section 3.4.7. The checksum file must be placed in the GFX folder. It must be named `<GFX.MD5>`

3.4.6 METADATA COMPANION FILE ON LTO TAPE

The graphics master must include an XML metadata companion file that describes the contents of the graphics master volume. The metadata companion file must be named <metadata.xml>. Discovery provides a web-based application for creating the required metadata file for all Discovery file based deliverables. Production partners can find the tool at <http://xml.discovery.com>. Production partners must create the metadata companion files using the web-based application. Discovery can't guarantee that XMLs created outside of the web-based application will meet Discovery's requirements.

3.4.7 LAYOUT OF FILES WITHIN THE LTFS VOLUME

The metadata companion file described in Section 3.4.6 must be written to the content area of the index partition of the LTFS Volume. The volume must have a single folder named GFX. All graphics element files must be placed in specific subfolders within the GFX folder. The files must be separated by element type using the convention shown in Table 3.4.7. Production partners must use only the subfolder names listed in Table 3.4.7. Discovery will reject graphics masters that do not match the folder structure shown below. The MD5 checksum file required by this standard must be placed in the GFX folder and named GFX.MD5.

Table 3.4.7 Graphics Elements Subfolders

Directory Name	Files Included
OPEN	Includes program open and accompanying elements
CREDITS	Includes credit beds and credit text
LOWER_THIRDS	Includes all lower third backgrounds and banners
MAPS	Includes all map graphics
OTHER	Includes all other elements not grouped in another category

Figure 6: Graphic Summary of the Layout of Files within the Volume

