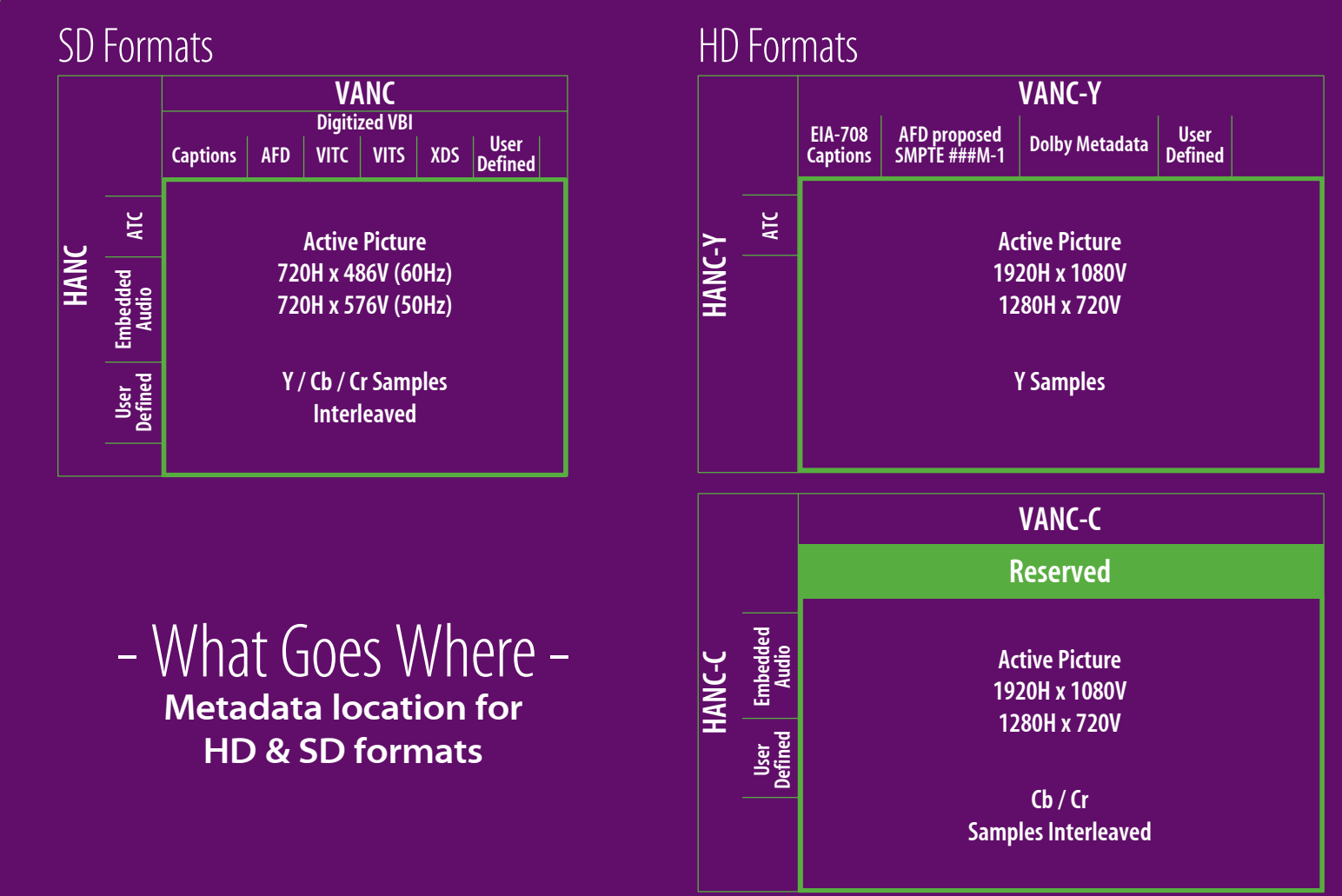


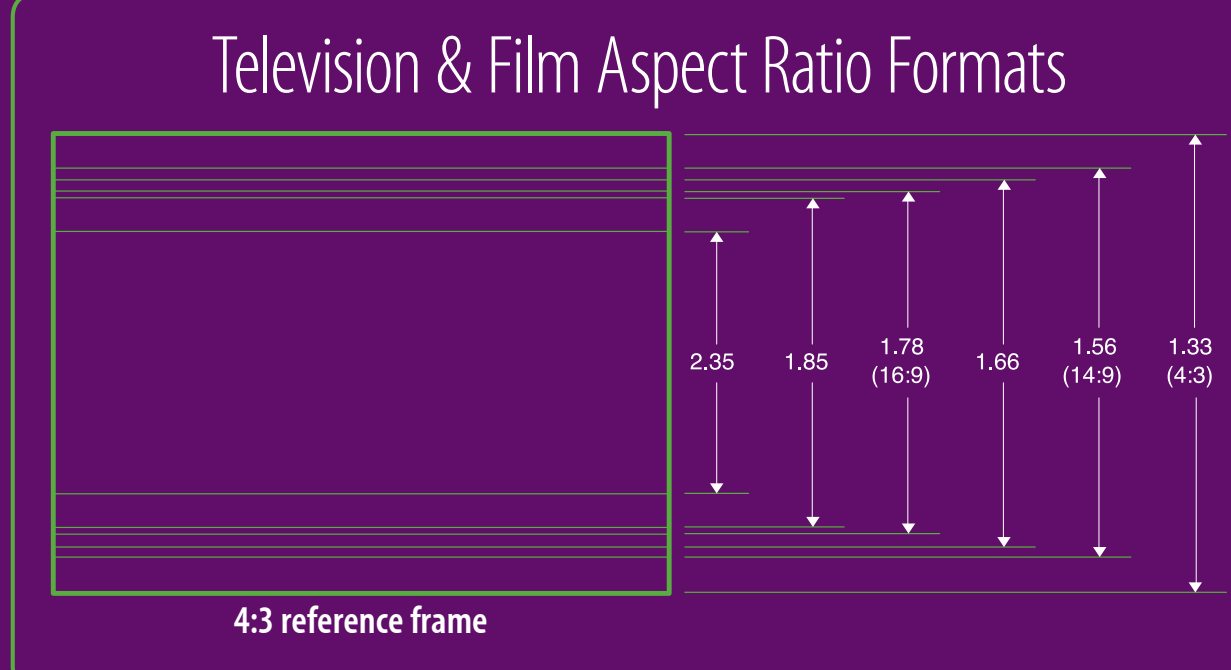
Digital Production Formats

| System Nomenclature | Display Aspect Ratio | Samples per total line (S/TL) ¹ | Total lines per frame | Samples per active line (S/AL) | Active lines per frame | Scanning Format | Frame Rate (Hz) | Line Rate (kHz) | Interface Sampling Frequency fs (MHz) ¹ | Active Bit Rate (Mbps) | Total Bit Rate (Mbps) | SMPTE Scan Format Standard | SMPTE Serial Interface Standard | ATSC Table 3 |
|-------------------------|----------------------|--|-----------------------|--------------------------------|------------------------|-----------------|-----------------|-----------------|--|------------------------|-----------------------|----------------------------|---------------------------------|--------------|
| SDTV | 4:3 | 910 | 525 | 768 | 486 | 2:1 Interlace | 29.97 | 15.73 | 14.32 | 111.9 | 143.2 | 244M | 259M-A | |
| 4:3 | 4:3 | 1135 | 625 | 948 | 576 | 2:1 Interlace | 25 | 15.63 | 17.73 | 136.5 | 177.3 | EBU | 259M-B | |
| 601 525 | 4:3/16:9 | 858 | 525 | 720 | 486 | 2:1 Interlace | 29.97 | 15.73 | 13.50 | 209.7 | 270.0 | 125M/267M | 259M-C | 27, 31 |
| 601 625 | 4:3/16:9 | 864 | 625 | 720 | 576 | 2:1 Interlace | 25 | 15.63 | 13.50 | 207.4 | 270.0 | EBU | 259M-C | |
| 601-18MHz 525 | 16:9 | 1144 | 525 | 960 | 486 | 2:1 Interlace | 29.97 | 15.73 | 18.00 | 279.7 | 360.0 | 267M | 259M-D | |
| 720x480/59.94/1:1 | 16:9 | 858 | 525 | 720 | 483 | 1:1 progressive | 59.94 | 31.47 | 27.00 | 416.9 | 540.0*** | 293M | 294M | 28 |
| 720x480/30/1:1 | 16:9 | ? | 525 | 720 | ? | 1:1 progressive | 30 | 15.75 | | | | 293M | 294M-C | 8 |
| 720x480/29.97/1:1 | 16:9 | ? | 525 | 720 | ? | 1:1 progressive | 29.97 | 15.73 | | | | 293M | 294M-C | 26 |
| HDTV | 1280x720/60/1:1 | 16:9 | 1650 | 750 | 1280 | 2:1 progressive | 60 | 45.00 | 74.25 | 1105.9 | 1485.0 | 296M | 292M | 6 |
| 1280x720/59.94/1:1 | 16:9 | 1650 | 750 | 1280 | 720 | 1:1 progressive | 59.94 | 44.96 | 74.18 | 1104.8 | 1483.5 | 296M | 292M | 24 |
| 1280x720/50/1:1 | 16:9 | 1980 | 750 | 1280 | 720 | 1:1 progressive | 50 | 37.50 | 74.25 | 921.6 | 1485.0 | 296M* | 292M | |
| 1280x720/30/1:1 | 16:9 | 3300 | 750 | 1280 | 720 | 1:1 progressive | 30 | 22.50 | 74.25 | 553.0 | 1485.0 | 296M* | 292M | 5 |
| 1280x720/29.97/1:1 | 16:9 | 3300 | 750 | 1280 | 720 | 1:1 progressive | 29.97 | 22.40 | 74.18 | 552.4 | 1483.5 | 296M* | 292M | 23 |
| 1280x720/25/1:1 | 16:9 | 3960 | 750 | 1280 | 720 | 1:1 progressive | 25 | 18.75 | 74.25 | 460.8 | 1485.0 | 296M* | 292M | |
| 1280x720/24/1:1 | 16:9 | 4125 | 750 | 1280 | 720 | 1:1 progressive | 24 | 18.00 | 74.25 | 442.4 | 1485.0 | 296M* | 292M | 4 |
| 1280x720/23.98/1:1 | 16:9 | 4125 | 750 | 1280 | 720 | 1:1 progressive | 23.98 | 17.99 | 74.19 | 442.0 | 1483.8 | 296M* | 292M | 22 |
| 1920x1035/60/2:1 | 16:9 | 2200 | 1125 | 1920 | 1035 | 2:1 interlace | 30 | 33.75 | 74.25 | 1192.3 | 1485.0 | 260M | 292M | |
| 1920x1035/59.94/2:1 | 16:9 | 2200 | 1125 | 1920 | 1035 | 2:1 interlace | 29.97 | 33.72 | 74.18 | 1191.1 | 1483.5 | 260M | 292M | |
| 1920x1080/60/1:1 | 16:9 | 2200 | 1125 | 1920 | 1080 | 1:1 progressive | 60 | 67.50 | 148.50 | 2488.3 | 2970.0 | 274M | | |
| 1920x1080/59.94/1:1 | 16:9 | 2200 | 1125 | 1920 | 1080 | 1:1 progressive | 59.94 | 67.43 | 148.35 | 2485.8 | 2967.0 | 274M | | |
| 1920x1080/50/1:1 | 16:9 | 2640 | 1125 | 1920 | 1080 | 1:1 progressive | 50 | 56.25 | 148.50 | 2073.6 | 2970.0 | 274M | | |
| 1920x1080/50/1:1 (1250) | 16:9 | 2376 | 1250 | 1920 | 1080 | 1:1 progressive | 50 | 62.50 | 148.50 | 2073.6 | 2970.0 | 295M | | |
| 1920x1080/60/2:1 | 16:9 | 2200 | 1125 | 1920 | 1080 | 2:1 interlace | 30 | 33.75 | 74.25 | 1244.2 | 1485.0 | 274M | 292M | 3 |
| 1920x1080/59.94/2:1 | 16:9 | 2200 | 1125 | 1920 | 1080 | 2:1 interlace | 29.97 | 33.72 | 74.18 | 1242.9 | 1483.5 | 274M | 292M | 21 |
| 1920x1080/50/2:1 | 16:9 | 2640 | 1125 | 1920 | 1080 | 2:1 interlace | 25 | 28.13 | 74.25 | 1036.8 | 1485.0 | 274M | 292M | |
| 1920x1080/50/2:1 (1250) | 16:9 | 2376 | 1250 | 1920 | 1080 | 2:1 interlace | 25 | 31.25 | 74.25 | 1036.8 | 1485.0 | 295M | 292M | |
| 1920x1080/30/1:1 | 16:9 | 2200 | 1125 | 1920 | 1080 | 1:1 progressive | 30 | 33.75 | 74.25 | 1244.2 | 1485.0 | 274M | 292M | 2 |
| 1920x1080/29.97/1:1 | 16:9 | 2200 | 1125 | 1920 | 1080 | 1:1 progressive | 29.97 | 33.72 | 74.18 | 1242.9 | 1483.5 | 274M | 292M | 20 |
| 1920x1080/25/1:1 | 16:9 | 2640 | 1125 | 1920 | 1080 | 1:1 progressive | 25 | 28.13 | 74.25 | 1036.8 | 1485.0 | 274M | 292M | |
| 1920x1080/24/1:1 | 16:9 | 2750 | 1125 | 1920 | 1080 | 1:1 progressive | 24 | 27.00 | 74.25 | 995.3 | 1485.0 | 274M | 292M | 1 |
| 1920x1080/23.98/1:1 | 16:9 | 2750 | 1125 | 1920 | 1080 | 1:1 progressive | 23.98 | 26.98 | 74.19 | 994.5 | 1483.8 | 274M | 292M | 19 |
| 1920x1080/30(f) | 16:9 | 2200 | 1125 | 1920 | 1080 | 1:1 Segmented | 30 | 33.75 | 74.25 | 1244.2 | 1485.0 | 274M** | 292M | 2 |
| 1920x1080/29.97(f) | 16:9 | 2200 | 1125 | 1920 | 1080 | 1:1 Segmented | 29.97 | 33.72 | 74.18 | 1242.9 | 1483.5 | 274M** | 292M | 20 |
| 1920x1080/25(f) | 16:9 | 2640 | 1125 | 1920 | 1080 | 1:1 Segmented | 25 | 28.13 | 74.25 | 1036.8 | 1485.0 | 274M** | 292M | |
| 1920x1080/24(f) | 16:9 | 2750 | 1125 | 1920 | 1080 | 1:1 Segmented | 24 | 27.00 | 74.25 | 995.3 | 1485.0 | 274M** | 292M | 1 |
| 1920x1080/23.98(f) | 16:9 | 2750 | 1125 | 1920 | 1080 | 1:1 Segmented | 23.98 | 26.98 | 74.19 | 994.5 | 1483.8 | 274M** | 292M | 19 |

Notes:
 * These formats are proposed to be added to SMPTE 296M
 ** These formats are proposed to be added to SMPTE 274M
 *** Although the total data rate of 720x480/1:1 is 540 Mbps, the actual interface may be any one of:
 - Single Link At 1.485 Gbps (proposed)
 - Single Link At 540 Mbps (proposed)
 - Dual Link At 270 Mbps
 - Single 4:2:0 Link at 360 Mbps
¹ Refers to Y sampling frequency for component formats and overall sampling frequency for composite formats
² Refers to Y sampling frequency except 4:3c formats where it refers to composite samples



- What Goes Where -
Metadata location for HD & SD formats



4:3 reference frame

Digital Storage Formats

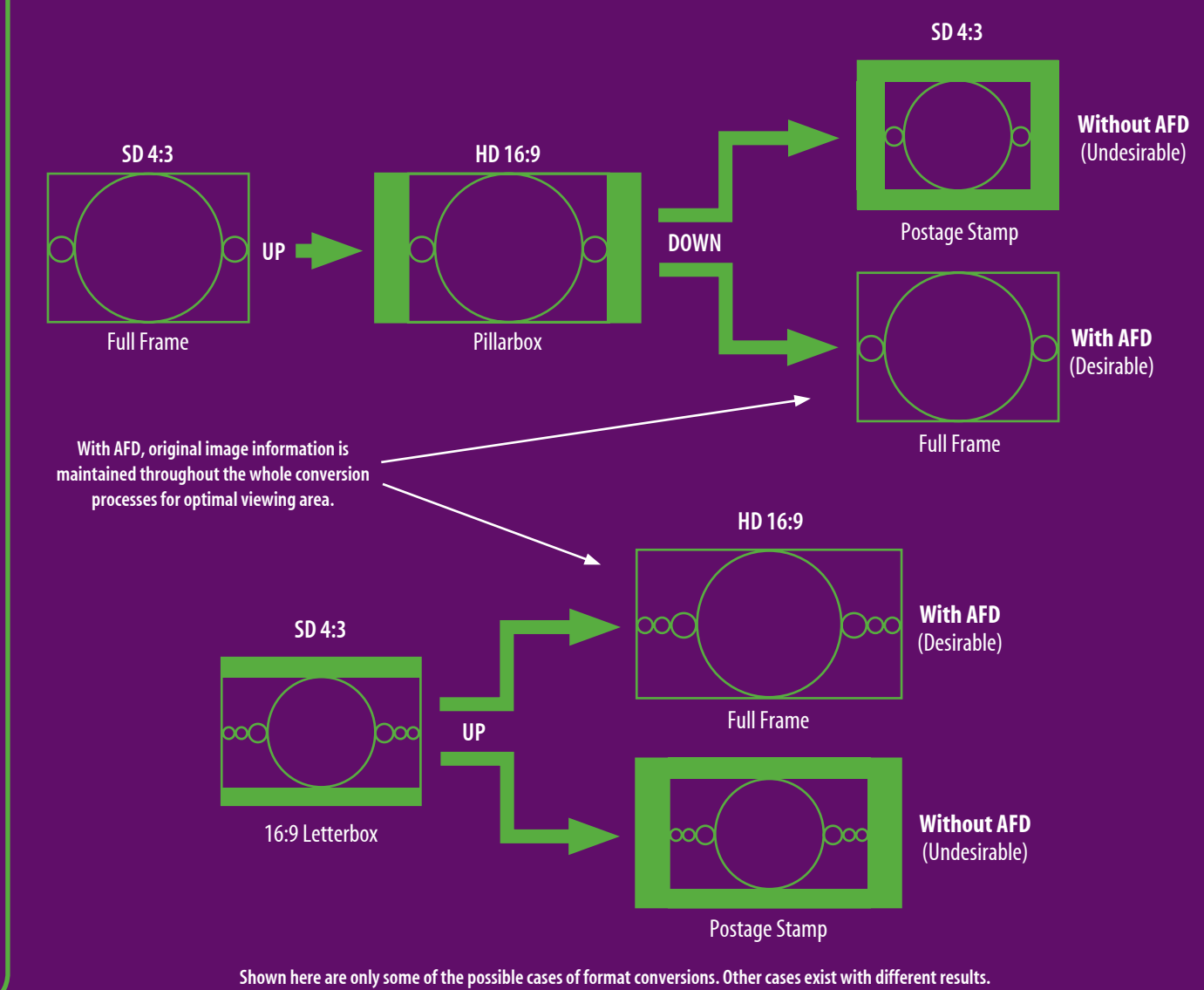
| Format Designation | Interface Standard | Media Size / Type | Sampling Format | Sampling Resolution note 1 | Video Sample Resolution (bits) | Essential Video Bit Rate (Mbps) note 1-2 | Recorded Video Bit Rate (Mbps) note 1 | Compression Type | Approximate Compression Ratio | # Audio Tracks | Audio Sample Resolution (bits) | Audio Sampling Frequency (kHz) | File Format |
|--------------------|---|---------------------------|---|-----------------------------------|--------------------------------|--|---------------------------------------|-----------------------|-------------------------------|----------------|--------------------------------|--------------------------------|-------------|
| D1 | SMPTE 259M-C | 19mm/Tape | 4:2:2 | 720x486 or 576 | 8 bits | 172 Mbps | 172 Mbps | none | - | 4 | 16-20 | 48 | |
| DV | IEEE-1394 | 1/4"/Tape | 4:1:1 (525/60) 4:2:0 (625/50) | 720x486 720x576 | 8 bits | 125 Mbps | 25 MBps | DCT I-frame | 5:1 | 2 | 16 | 48 | |
| DVCAM | IEEE-1394 | 1/4"/Tape | 4:1:1 (525/60) 4:2:0 (625/50) | 720x486 720x576 | 8 bits | 125 Mbps | 25 MBps | DCT I-frame | 5:1 | 2 | 16 | 48 | |
| DVCPRO 50 | IEEE-1394, SMPTE 259M-C | 1/4"/Tape | 4:2:2 | 720x486 or 576 | 8 bits | 168 Mbps | 50 MBps | DCT I-frame | 3.3:1 | 4 | 16 | 48 | |
| D7:DVCPRO | IEEE-1394, SMPTE 259M-C | 1/4"/Tape | 4:1:1 (525/60) 4:1:1 (625/50) | 720x486 720x576 | 8 bits | 125 Mbps | 25 MBps | DCT I-frame | 5:1 | 2 | 16 | 48 | |
| D9 Digital-S | IEEE-1394, SMPTE 259M-C | 1/2"/Tape | 4:2:2 | - | 8 bits | 168 Mbps | 50 MBps | DCT I-frame | 3.3:1 | 2 | 16 | 48 | |
| Betacam SX | SMPTE 259M-C | 1/2"/Tape | 4:2:2 | 720x486 or 576 | 8 bits | 176 Mbps | 18 MBps | MPEG-2 4:2:2 P@M | 10:1 | 4 | 16 | 48 | |
| Digital Betacam | SMPTE 259M-C | 1/2"/Tape | 4:2:2 | 720x486 or 576 | 10 bits | 219 Mbps | 95 MBps | DCT | 2.3:1 | 4 | 16-20 | 48 | |
| IMX | SMPTE 259M | 1/2"/Tape | 4:2:2 | 720x486 or 576 | 8 bits | 168 Mbps | 50 MBps | MPEG-2 4:2:2 P@M | - | 8/4 | 16-24 | 48 | |
| XDCAM | IEEE-1394, SMPTE 259-C, Ethernet | 120mm dia./Disc | 4:1:1 (525/60) 4:2:0 (625/50) | 720x486 720x576 | 8 bits | 125 Mbps | 25 MBps | DV | 5:1 | 4 | 16 | 48 | MXF |
| DVCPRO HD | IEEE-1394, SMPTE 259M-C | 1/4"/Tape | 4:2:2 | - | 8 bits | 168 Mbps | 50/40/30 MBps | MPEG-2 4:2:2 P@M | variable | 8/4 | 16-24 | 48 | |
| DS HD | SMPTE 259M-C, 292M | 1/2"/Tape | 4:2:2 | 1920x1080 | 10 bits | 1244 Mbps | 276 MBps | DCT | 4.5:1 | 4 | 20 | 48 | |
| HDCAM | SMPTE 259M-C, 292M | 1/2"/Tape | 3:1:1 | 1440x1080 | 8 bits | 994 Mbps | 140 MBps | DCT | 7.1:1 | 4 | 20 | 48 | |
| HDCAM-SR | SMPTE 259M-C, 292M | 1/2"/Tape | 4:2:2 | 1920x1080 | 10 bits | 1244 Mbps | 440 MBps | MPEG-4 Studio Profile | 2.7:1 | 12 | 24 | 48 | |
| HDTV | IEEE-1394 | 1/4"/Tape | 4:4:4 | 1440x1080 (HD2) 1280x720 (HD1) | 8 bits | 1495 Mbps | 560 MBps 19 MBps (720p) | MPEG-2 MP@H1440 | - | 2 | 16 | 48 | |
| Infinity | SMPTE 259M, 292M, USB2.0, IEEE-1394, Ethernet | Iomega disc, CompactFlash | 4:1:1 (525/60) 4:2:0 (625/50) 4:2:2 (SD/HD) | 720x486 720x576 - | 8 bits | 125 Mbps | 25 MBps | DV | - | 8 | - | - | MXF |
| XDCAM-HD | IEEE-1394, SMPTE 292M, Ethernet | 120mm dia./Disc | 4:2:0 | 1440 x 1080 | 8 bits | 560 Mbps | 35/25/18 MBps | MPEG-2 MP@HL | variable | 2/4 | 16 | 48 | MXF |

note 1: Not all vendors provide the information contained in these fields. Quoted values are approximated and are based on researches from unofficial industry sources. Some differences may exist.
 note 2: Refers to the data presented to the compression encoder.

Miranda

Digital Television & Production Standards

Why is AFD Important When Doing Conversion?



Shown here are only some of the possible cases of format conversions. Other cases exist with different results.

Active Format Description (AFD)

| AFD CODES | Original 4:3 coded frame | AFD CODES | Original 16:9 coded frame |
|-----------|---|-----------|---|
| 0000 | Undefined Notes: - Code 0000 indicates that information is unavailable, therefore video equipment should interpret active format the same as coded frame unless "bar data" is available. - May not be supported worldwide. - Should be used with caution. | 0000 | Undefined Notes: - Code 0000 indicates that information is unavailable, therefore video equipment should interpret active format the same as coded frame unless "bar data" is available. - May not be supported worldwide. - Should be used with caution. |
| 0001 | Reserved | 0001 | Reserved |
| 0010 | 16:9 image at top of frame Notes: - May not be supported worldwide. - Should be used with caution. | 0010 | 16:9 image, same as coded frame Notes: - For a 16:9 frame, AFD code 0010 resulted in the same image as AFD code 1000, therefore code 1000 is preferred coding in such case. |
| 0011 | 14:9 image at top of frame Notes: - May not be supported worldwide. - Should be used with caution. | 0011 | 14:9 image, same as coded frame Notes: - For a 16:9 frame, AFD code 0011 resulted in the same image as AFD code 1011, therefore code 1011 is preferred coding in such case. |
| 0100 | greater than 16:9 image centered in frame ex: image area = 2.35 Notes: - Bar data should always be associated with AFD code 0100 to signal the exact size of letterbox bars. - May not be supported worldwide. - Should be used with caution. | 0100 | Greater than 16:9 image centered in frame ex: image area = 2.35 Notes: - Bar data should always be associated with AFD code 0100 to signal the exact size of letterbox bars. - May not be supported worldwide. - Should be used with caution. |
| 0101 | Reserved | 0101 | Reserved |
| 0110 | Reserved | 0110 | Reserved |
| 0111 | Reserved | 0111 | Reserved |
| 1000 | Full frame image same as coded frame | 1000 | Full frame image same as coded frame |
| 1001 | 4:3 image centered in frame Note: - For a 4:3 frame, AFD code 1001 resulted in the same image as AFD code 1000, therefore code 1000 is preferred coding in such case. | 1001 | 4:3 image centered in frame |
| 1010 | 16:9 image centered in frame Note: - All image area is protected, therefore cropping is not allowed and only letterbox format can be used. | 1010 | 16:9 image full frame Note: - All image area is protected, therefore cropping is not allowed. |
| 1011 | 14:9 image centered in frame | 1011 | 14:9 image centered in frame |
| 1100 | Reserved | 1100 | Reserved |
| 1101 | 4:3 image with shoot & protect 14:9 center Note: - Visual information outside protected area may be cropped with minimum impact for the viewer | 1101 | 4:3 image with shoot & protect 14:9 center Note: - Visual information outside protected area may be cropped with minimum impact for the viewer |
| 1110 | 16:9 image with shoot & protect 14:9 center Note: - Visual information outside protected area may be cropped with minimum impact for the viewer | 1110 | 16:9 image with shoot & protect 14:9 center Note: - Visual information outside protected area may be cropped with minimum impact for the viewer |
| 1111 | 16:9 image with shoot & protect 4:3 center Note: - Visual information outside protected area may be cropped with minimum impact for the viewer | 1111 | 16:9 image with shoot & protect 4:3 center Note: - Visual information outside protected area may be cropped with minimum impact for the viewer |

Based on proposed SMPTE 428M-1 standard. Changes may occur until adoption of standard, 2006

MPEG-2 Profiles & Levels Chart for Defined "P@L" Combinations

| LEVELS | Max Resolution Max Frame Rate | Max Bit Rate | Max Bit Rate | Max Bit Rate | Max Bit Rate | Max Bit Rate | Max Bit Rate | A measure of Decoder Complexity | |
|-----------|-------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------------------------|----------|
| | | | | | | | | PROFILES | PROFILES |
| High | 1920 x 1152 60 fps | 80 Mbps | | | 100 Mbps | 300 Mbps | | 1920 x 1080 60 fps | |
| High 1440 | 1440 x 1152 60 fps | 60 Mbps | | 60 Mbps | 80 Mbps | | | note 2 | |
| Main | 72 | | | | | | | | |