



COMCAST TECHNOLOGY SOLUTIONS

AD DELIVERY FORMAT SPECS – “SLATED”

The following are the audio and video technical specifications for SD and HD spots submitted to Comcast Technology Solutions.

FILE LAYOUT FOR COMCAST TECHNOLOGY SOLUTIONS

For all SD and HD spots submitted to Comcast Technology Solutions, spots must be submitted at below length:

| Spec 1 | Leading Black | Slate | Black | Spot | Trailing Black |
|----------|----------------|------------------|-----------------|--|----------------|
| “Slated” | 0 sec/0 frames | 5 sec/150 frames | 2 sec/60 frames | 15 sec/450 frames, 30 sec/900 frames, 60 sec/1800 frames, 90 sec/2700 frames, 120 sec/3596 frames, 5 min/8992 frames | 0 sec/0 frames |

HD VIDEO FORMATS

| | Recommended Format—MPEG | Quicktime | Quicktime |
|--------------------------------------|--|--|--|
| Stream Type | MPEG-2 TS MPEG-2 PS | Apple ProRes 422 | Avid DNxHD |
| Video Bitrate | 20 - 100 Mbps (CBR or VBR) | 40 - 220 Mbps (VBR) | 145/220 Mbps (CBR) |
| Frame Rate | 29.97 (1080i), 23.976 (1080p) 59.94 (720p) **native frame rate is preferred | 29.97 (1080i), 23.976 (1080p) 59.94 (720p) **native frame rate is preferred | 29.97 (1080i), 23.976 (1080p) 59.94 (720p) **native frame rate is preferred |
| GOP Structure | Closed GOP | N/A | N/A |
| Closed Captioning¹ | EIA-608 and EIA-708 | EIA-608 and EIA-708 | EIA-608 and EIA-708 |
| Chroma | 4:2:0, 4:2:2 | 4:2:2 | 4:2:2 |
| Interlacing | Upper Field First (29.97), Progressive (23.976/59.94) | Upper Field First (29.97), Progressive (23.976/59.94) | Upper Field First (29.97), Progressive (23.976/59.94) |
| Aspect Ratio | 16:9 | 16:9 | 16:9 |
| Width/Height³ | 1920x1080 1280x720 | 1920x1080 1280x720 | 1920x1080 1280x720 |
| Audio Type | MPEG-1 Layer 2 AES (MPEG-2 TS Only) | LPCM | LPCM |
| Typical Transfer² | 2-40 minutes | 4-90 minutes | 15-90 minutes |
| Typical Export³ | < 1 minute | < 1 minute | < 1 minute |
| Notes | MP@HL HP@HL | ProRes 422 LT, ProRes 422, ProRes 422 HQ are all acceptable | DNxHD 145, DNxHD 220 are both acceptable |

SD VIDEO FORMATS

| | Recommended Format—MPEG | Quicktime |
|--------------------------------------|---|---|
| Stream Type | MPEG-2 Program Stream | Apple ProRes 422 |
| Video Bitrate | 12 - 30 Mbps (CBR or VBR) | 20 - 65 Mbps (VBR) |
| Frame Rate | 29.97 23.976 **native frame rate is preferred | 29.97 23.976 **native frame rate is preferred |
| GOP Structure | Closed GOP | N/A |
| Closed Captioning¹ | EIA-608 | EIA-608 |
| Chroma | 4:2:0; 4:2:2 | 4:2:2 |
| Interlacing | 29.97 Upper Field First 23.976 Progressive | 29.97 Upper Field First 23.976 Progressive |
| Aspect Ratio | 4:3 | 4:3 |
| Width/Height | 720x486/512 | 720x486 |
| Audio Type | MPEG-1 Layer 2 | LPCM |
| Typical Transfer² | 1-5 minutes | 2-24 minutes |
| Typical Export³ | < 1 minute | < 1 minute |
| Notes | MP@ML, HL, HP@HL, 422@ML, HL are all acceptable | ProRes 422 LT, ProRes 422, ProRes 422 HQ are all acceptable |

30s to 2m spot assuming an average bandwidth of 5 Mbps. Use <http://speedtest.comcast.net/> to give you an idea of your bandwidth. 5 Mbps is the suggested minimum bandwidth.

³Estimated time to fully export from Avid or Final Cut Pro.

⁴For MPEG formats, Comcast Technology Solutions supports SD closed captioning in an EIA-608 encoding. For MPEG-TS Supply the EIA-608 encoding in both ATSC A/53 user data and additionally as SCTE-20 user data (for MPEG-PS ATSC A/53 only is required). For QuickTime formats, Comcast Technology Solutions supports SD closed captioning in an EIA-608 encoding stored as a QuickTime closed captioning text track.

⁵For MPEG formats, Comcast Technology Solutions supports HD closed captioning in an EIA-708 encoding in ATSC A/53 user data. An additional EIA-608 encoding, also as ATSC A/53 user data, is required for backwards compatibility reasons. For QuickTime formats, Comcast Technology Solutions supports closed captioning in an EIA-708 encoding as a QuickTime closed captioning text track. An additional EIA-608 encoding also within a QuickTime closed captioning text track is required for backwards compatibility reasons.

⁸Comcast Technology Solutions adheres to SMPTE RP 2046-2 - title safe areas should be 90% of the width and 90% of the height of the part of the image to be extracted. Comcast Technology Solutions determines duration based on 29.97 DF regardless of source media frame rate. All content delivered over :120, should be edited and uploaded using DF.

Comcast Technology Solutions adjusts each outbound transcode to conform to receiver specifications, both audio and video.

COMCAST TECHNOLOGY SOLUTIONS

ADDELIVERY FORMAT SPECS

HD/SD AUDIO FORMATS

| | HD & SD | HD & SD | HD ONLY |
|-------------------------------------|----------------|----------------------------------|-----------------------------------|
| Encoding Type | MPEG-1 Layer 2 | AES/LPCM | AES/LPCM |
| Number of Channels | 2 - Stereo | 2- Stereo | 6, 8, or 10 |
| PIDs/Channel per PID | 1/2 | 1/2 | 3/2, 4/2, 5/2, 1/6, 1/8. 1/10 |
| Channel 1 | Stereo Left | Stereo Left | Left Front |
| Channel 2 | Stereo Right | Stereo Right | Right Front |
| Channel 3 | | Mono SAP (optional) ⁷ | Center |
| Channel 4 | | Mono VDS (optional) ⁷ | Low Frequency Effects |
| Channel 5 | | | Left Surround |
| Channel 6 | | | Right Surround |
| Channel 7 | | | Lt Stereo (optional) ⁶ |
| Channel 8 | | | Rt Stereo (optional) ⁶ |
| Channel 9 | | | Mono SAP (optional) ⁷ |
| Channel 10 | | | Mono VDS (optional) ⁷ |
| Bit Depth | 16 | 16 | 16 |
| Bit Rate | 384 Kbps | 1536 Kbps | 1536 Kbps |
| Sampling Rate | 48 KHz | 48 KHz | 48 KHz |
| Instantaneous Peak Audio Max | -8 dBFS | -8 dBFS | -8 dBFS |
| Average Peak Audio Max | -10 dBFS | -10 dBFS | -10 dBFS |
| Average Levels | -20 dBFS | -20 dBFS | -20 dBTP |
| True Peak | -2 dBTP | -2 dBTP | -2 dBTP |

When sending 5.1 audio, the Lt/Rt pair is optional and we will automatically create the pair as a mix down of the 5.1 channels. If the Lt/Rt pair is included then we will use those and not create a mix down. Both sides of the pair must be included. If you do *not* have Lt/Rt pair do not send these channels as silence, but rather do not include these channels.

Any audio on channel 3,4 when sending stereo or channel 9,10 when sending 5.1 is assumed to be SAP and VDS. If you do *not* have SAP *and* VDS do not send these channels as silence, but rather do not include these channels. If you have SAP *or* VDS then include both channels but make the one you don't have silent (even throughout the slate - no beeps or tone during the slate). Please make sure audio levels meet FCC CALM ACT requirements.

COMCAST TECHNOLOGY SOLUTIONS RADIO SPECIFICATION

The following are the radio technical specifications for SD and HD spots submitted to Comcast Technology Solutions.

FILE LAYOUT FOR COMCAST TECHNOLOGY SOLUTIONS

Radio spots submitted to Comcast Technology Solutions are not checked for duration and may include slates of any length.

RADIO FORMATS

| | Recommended Format—MPEG | WAV | WAV |
|-------------------------------------|--|----------------------|----------------------|
| Encoding Type | MPEG-1 Layer 3 (MP3) MPEG-1 Layer 2 (MP2) | PCM | PC |
| Extension | .mp3, .mp2 | .wav | .aif |
| Number of Channels | 2 (Stereo) | 2 (Stereo) | 2 (Stereo) |
| Bit Depth | 16, 24 | 16, 24 | 16, 24 |
| Bit Rate | 192 – 320 Kbps | 1536 Kbps, 2304 Kbps | 1536 Kbps, 2304 Kbps |
| Sampling Rate | 44.1 KHz, 48 KHz | 44.1 KHz, 48 KHz | 44.1 KHz, 48 KHz |
| Instantaneous Peak Audio Max | -8 dBFS | -8 dBFS | -8 dBFS |
| Average Peak Audio Max | -10 dBFS | -10 dBFS | -10 dBFS |
| Average Levels | -20 dBFS | -20 dBFS | -20 dBFS |