



What Is True Native Uncompressed 8K@60Hz Output

Many USB-C to HDMI adapters on the market are marked “8K supported”, yet most of these are merely marketing claims and do not deliver genuine 8K@60Hz. Some only reach 8K@30Hz, while others rely on DSC compression to hit 8K@60Hz. Neither qualifies as **native uncompressed 8K@60Hz RGB 4:4:4** required for professional use. A converter capable of true native 8K@60Hz demands a full qualified chain: source, bridge chip, cable and display.

1. Source Side: USB-C Must Be 4-Lane HBR3 DP1.4 Alt Mode

USB-C outputs DP video via DP Alt Mode. To carry uncompressed 8K@60Hz, the host USB-C port must provide a full **4-lane DP1.4 link at HBR3** (8.1Gbps per lane).

2-lane ports or HBR2 links lack sufficient bandwidth for uncompressed 8K@60Hz RGB 4:4:4. Many thin-and-light laptops and tablets only allocate 2 DP lanes to their USB-C ports; even paired with premium adapters, they cannot achieve native 8K60.

2. Bridge Chip: HDMI2.1 FRL Required, Not HDMI2.0 TMDS

This is the most common pitfall. HDMI2.0 uses legacy TMDS signaling and does not have enough bandwidth for 8K@60Hz. ASL CS5363 and CS5365 are HDMI2.0 TMDS chips capped at 4K@60Hz with no 8K capability.

True 8K@60Hz depends on **FRL (Fixed Rate Link)**, the exclusive signaling standard for HDMI2.1. Only CS5563 / CS5565 / CS5569 HDMI2.1 FRL bridge chips can convert DP1.4 HBR3 to HDMI2.1 FRL for 8K@60Hz output.

3. No Mandatory DSC Compression for Native Path

DSC (Display Stream Compression) is a VESA visually lossless compression standard used to transmit high-resolution video under limited bandwidth.

Our definition of **true 8K@60Hz** is **stable output without DSC compression**. If an adapter requires DSC enabled to light up 8K@60Hz, it is compressed 8K, not native uncompressed 8K. For professional color grading, machine vision and digital signage, DSC compression introduces risks including color artifacts, latency and flicker, making it unsuitable.

4. Sink Side: Display Must Support HDMI2.1 FRL

A compliant adapter alone cannot guarantee 8K@60Hz. The display is also a critical part of the link.

HDMI2.0 sinks do not support FRL negotiation; the link will fall back to TMDS automatically. To run native 8K60, your monitor, TV or capture device must be HDMI2.1 FRL capable.

5. Cable Signal Integrity for Stable High-Speed Link

Higher bandwidth makes signals more sensitive to attenuation and interference. For integrated cable adapters, the cable must meet high-speed electrical specs to maintain stable HBR3 DP and HDMI2.1 FRL training up to 1.8m. Cheap generic “8K cables” have insufficient margin and frequently drop link, show flickering or sparkles.

6. Stable USB VBUS 5V Power Delivery

Bridge chips draw peak current during FRL link training. Insufficient current or voltage drop from the host USB port will cause FRL handshake failure and force the link to downgrade, locking you out of 8K@60Hz. This power requirement is often overlooked for active adapters.

📄 7. Compliant EDID Firmware with Real Native 8K@60 FRL Timing

EDID communicates supported resolutions and refresh rates between host and display. Genuine 8K adapters report valid native 8K@60 FRL timings. Many low-cost adapters spoof EDID to advertise 8K modes that the hardware cannot sustain, which is false specification marketing.

⚠️ 8. Two Common Fake 8K@60Hz Product Types

- **HDMI2.0 TMDs (CS5363 / CS5365):** Hardware limited to 4K@60Hz, often falsely advertised as 8K@60Hz.
- **DSC-dependent HDMI2.1 (CS5563/CS5565/CS5569):** Can output 8K@60Hz only with DSC compression. Not native uncompressed, suitable for gaming but not professional color-critical work.

📊 Comparison Table: Native Uncompressed 8K@60Hz vs DSC Compressed 8K vs 4K@60 HDMI2.0

Item	Native Uncompressed 8K@60Hz RGB4:4:4	DSC Compressed 8K@60Hz	HDMI2.0 4K@60Hz (CS5363/CS5365)
Video Protocol	HDMI2.1 FRL	HDMI2.1 FRL	HDMI2.0 TMDs
DSC Required	❌ No, native pass-through	✅ DSC mandatory	— DSC decode supported, no 8K bandwidth
Color Format	RGB 4:4:4 uncompressed	RGB 4:4:4 (compressed)	RGB 4:4:4 uncompressed
Host Requirement	USB-C 4-lane DP1.4 HBR3	USB-C 2/4 lane DP	USB-C 2/4 lane DP
Sink Requirement	HDMI2.1 FRL display	HDMI2.1 FRL display	HDMI2.0 display sufficient
Image Risks	No compression loss	Potential artifacts, latency, flicker	No compression loss, capped at 4K@60
Typical Use Cases	Color grading, machine vision, signage, workstation	Gaming, general media playback	Office, 4K media, regular monitors
Common Marketing Label	True 8K@60 Uncompressed	8K@60 with DSC	4K@60 (often falsely labeled 8K)

📌 **Compatibility Note:** Even with full compliant hardware, base Apple Silicon M1/M2/M3 Macs are limited by macOS DP Alt Mode and cannot output 8K@60Hz, maxing out at 4K@60Hz. Windows / Linux workstations with 4-lane HBR3 USB-C or Thunderbolt ports are required for native 8K60.