NASA 8K Plexenc — Test Report v1.2

Two parallel benchmarks: synthetic 8K UHD @ 60 fps and real NASA 8K DCI @ 23.976 fps — mathematically verifiable, transparent methodology.

Summary

This report documents **two independent benchmarks** of Plexenc compression on 8K video content. Both were run on August 10, 2026 with the same encoder pipeline, but on different test clips:

Benchmark A uses a synthetic 8K UHD pattern at 60 fps — reference for the streaming industry's typical parameters.

Benchmark B uses a real NASA 8K DCI file at 23.976 fps — evidence that the compression works on actual produced content, not just synthetic patterns.

Both are real, verifiable results. The difference in raw size (17.92 GB vs. 7.15 GB) is not due to uncertainty — it is because fps and resolution differ.

Parameters side by side

Parameter	A — Synthetic 8K UHD	B — NASA 8K DCI
Source	Synthetic pattern	NASA "Moving Water"
Resolution	7680 × 4320	8192 × 4096
Fps	60	24000/1001 = 23.976
Frames	180	71
Duration	3.00 s	2.96 s
Verified with	Encoder log	ffprobe + ls -l

File sizes (verified)

Measured size	A (bytes)	A (SI)	B (bytes)	B (SI)
Raw video	17,915,904,000	17.92 GB	7,147,094,016	7.15 GB
Raw audio	864,000	864.00 KB	568,568	568.57 KB
H.264 MP4	10,176,686	10.18 MB	16,643,985	16.64 MB
WAV audio	576,044	576.04 KB	568,612	568.61 KB
Plexenc semantic (total)	**489**	**489 B**	**445**	**445 B**
Plexenc glyph-PNG	296,091	296.09 KB	251,733	251.73 KB

Compression ratios

Ratios are computed directly from the byte values above. All numbers can be reproduced with simple division.

Comparison	A	B
Raw / H.264	1,760.5×	429.4×
H.264 / Plexenc semantic	20,811×	37,402×
H.264 / Plexenc glyph-PNG	34.4×	66.1×
Raw / Plexenc semantic	36,637,840×	16,060,885×
Raw / Plexenc glyph-PNG	60,508×	28,392×

Arithmetic identities — provable

Benchmark A (synthetic 8K UHD):

`Raw video: 7680 × 4320 × 3 bytes/pixel × 180 frames = 99,532,800 × 180 =` **`17,915,904,000 bytes`**

`Raw audio: 48,000 Hz × 2 channels × 3 bytes/sample × 3.0 s ≈` **`864,000 bytes`** `(24-bit audio)`

Benchmark B (NASA 8K DCI):

`Raw video: 8192 × 4096 × 3 bytes/pixel × 71 frames = 100,663,296 × 71 =` **`7,147,094,016 bytes`**

`Raw audio: 48,000 Hz × 2 channels × 2 bytes/sample × 2.961 s ≈` **`568,568 bytes`** `(16-bit audio)`

`Frame-count cross-check: 2.961 s × 24000/1001 fps = 71 frames (confirmed)`

Semantic integrity (byte-perfect roundtrip)

Stream	A: sent	A: received	B: sent	B: received
Video semantics	63 B	63 B	24 B	24 B
Audio semantics	426 B	426 B	421 B	421 B
Match	100.0%	100.0%	100.0%	100.0%

Honest qualification: semantic vs. pixel-perfect

Plexenc compression is **semantic**, not pixel-perfect. We encode *what happens* — motion, color, keyframes, tone — not each individual pixel. The AI receiver reconstructs video and audio from a semantic description, not from byte-level data.

Byte-perfect roundtrip of the semantic stream: 100% integrity in both benchmarks (verified via md5 fast-path).

Pixel-perfect comparison: this is *not* lossless compression of the original file. Reconstruction quality depends on the AI receiver's capacity and semantic resolution. The report does not claim that the Plexenc replacement is visually identical to the original.

Method notes

Benchmark A — Synthetic 8K UHD

Reference benchmark for the 8K UHD streaming scenario. H.264 encoded with x264 (ffmpeg medium preset). Raw value is theoretical (never physically stored).

The raw value is the theoretical memory footprint if each frame were stored as raw RGB — never physically written to disk. H.264 compression was run with ffmpeg medium preset for a realistic streaming comparison.

Benchmark B — NASA 8K DCI (real file)

Measured on the actual NASA file (ffprobe-verified). The H.264 reference is NASA's original encoded MP4 at high bitrate (44.96 Mbps), not re-compressed.

The raw value is the equivalent memory footprint for 71 frames. The H.264 reference is NASA's original distributable file (44.96 Mbps) — much higher bitrate than typical streaming, so ratios against H.264 are conservative compared to YouTube/Netflix levels.

Why two benchmarks?

A synthetic test shows **encoder capacity** under controlled conditions: the same fps the streaming industry uses, compressed with the same codec (H.264), on a pattern not drawn from any single source. A real NASA test shows **encoder behavior** on actual produced content — including motion, color variation, and complexity that are difficult to reproduce synthetically.

Together the two benchmarks cover both the industry-standard scenario (A) and real-world verification (B). Whichever test a third party runs next, they can reproduce one of these two.

Reproducibility

All numbers can be verified. Benchmark B can be reproduced directly from the source file:

```
$ ls -l nasa_8k_3sec.mp4 → 16,643,985 bytes
$ ffprobe -v error -show_entries stream=width,height,r_frame_rate,nb_frames \
-of json nasa_8k_3sec.mp4 → 8192×4096, 24000/1001 fps, 71 frames
$ cat benchmark_results.json → plexenc_video: 24 B, plexenc_audio: 421 B, total: 445 B
```

Benchmark A can be reproduced by generating a 7680×4320 RGB pattern @ 60 fps × 3 s and running the encoder pipeline. Full source code and benchmark data available under NDA.

Changelog from v1.1 to v1.2

• **Both benchmarks integrated:** v1.1 covered only NASA 8K DCI. v1.2 adds the synthetic 8K UHD @ 60 fps benchmark from Aug 10 as an equal parallel.

• **Side-by-side comparison tables:** All key measures (parameters, file sizes, compression ratios, integrity) presented side by side.

• **Arithmetic identities for both:** Both A and B include explicit calculations that can be cross-verified from base parameters.

• **New "Why two benchmarks?" section:** Explains why both synthetic and real source are necessary for a complete assessment.

Plexadi International — technical verification report. Source code and benchmark data available under NDA. Contact: ceo@plexadi.com