

Hyperspectral

Lossless, Phidelity: -6 % against CCSDS 123, -22 % against JPEG XL at maximum effort, -28 % against JPEG-LS.

Data

AVIRIS (Cuprite, Indian Pines, Salinas) and ROSIS (Pavia), public cubes of 103 to 224 bands, 13 to 14 bits. 4 sequences, 117 MB raw.

On PC — one core

Codec	Lossless ratio	Bits per sample (lower = better)				Lossless speed (M samples/s)		Memory (MB)
		lossless	±1	±2	±4	encoding	decoding	
Phidelity compact	×2.91	5.493	4.347	3.610	2.827	10.0	11.6	95.5
Phidelity light	×2.63	6.083	4.563	3.878	3.098	67.2	76.6	119.8
JPEG XL e3	×2.12	7.534	—	—	—	22.2	24.7	22.3
JPEG XL e7	×2.25	7.108	5.789	5.137	4.392	1.7	14.5	23.6
JPEG XL e9	×2.27	7.047	—	—	—	0.4	15.2	24.2
JPEG-LS	×2.09	7.666	6.170	5.466	4.670	47.3	49.5	18.4
CCSDS 123 ref.	×2.75	5.814	4.276	3.597	2.894	25.1	24.5	132.7

Embedded — instructions counted in emulation

ARM Cortex-A53, 64-bit

Codec	b/sample lossless	Instr./sample encoding	Instr./sample decoding	Encoding memory (KB)	Decoding memory (KB)
Phidelity compact	7.858	1,796	1,190	621	72
Phidelity fast	7.827	1,145	999	70	64
Phidelity light	8.642	241	218	1,116	656
JPEG-LS (CharLS)	9.110	278	236	39	39
CCSDS 123.0-B-2	8.424	487	495	9	9

Cortex-M7 (microcontroller)

Codec	b/sample lossless	Instr./sample encoding	Instr./sample decoding	Encoding memory (KB)	Decoding memory (KB)
Phidelity compact instructions and memory on a reduced sample	7.858	2,758	1,898	621	72
Phidelity fast	7.827	1,834	1,634	70	64
Phidelity light instructions and memory on a reduced sample	8.642	830	817	1,116	656
JPEG-LS (CharLS)	9.110	310	273	39	39
CCSDS 123.0-B-2	8.424	879	816	9	9

Good to know

- CCSDS 123 is the space standard: one setting for all cubes, no per-cube tuning.

Conditions

- PC: AMD Ryzen 7 8700F, a single core; every file decoded and compared with the original (zero error lossless, at most k in ±k).
- ±k: guaranteed maximum error of k on every sample. Phidelity and JPEG-LS (NEAR) hold it natively; for JPEG XL and the reference format, the image is first rounded to a $2k + 1$ step, then coded losslessly.
- Codecs: libxl 0.12 (efforts 3, 7 and 9), CharLS (JPEG-LS), OpenJPEG (JPEG 2000), FFV1 through ffmpeg, LERC, CCSDS 123.0-B-2 (encoder written for the benchmark, byte-identical to the NTNU verification model).
- Memory: peak private memory during the call only, measured on the largest item of the set.
- Embedded: instruction counts in emulation (QEMU), not board timings; cropped samples, sizes comparable with each other only. Compact and light through the 1.7 kit, fast through its core; in both cases with a caller-provided output buffer. Byte-identical streams on PC and ARM. Code on Cortex-M7: fast 73 KB, compact 92 KB, CharLS 205 KB, CCSDS 123 6 KB.