

# AQEA — Generation-5 Information-Geometry Substrate

Two-Page Executive Briefing · Public-Safe · v1.5 · 2026-05-09

NextX AG

**Patent-Pending.** 16 USPTO Provisional Patent Applications filed same-day on **May 9, 2026**, Customer Number **219394**, Application Numbers **64/061,723–752**. PCT-International + Non-Provisional conversion scheduled for May 2027.

## AQEA Substrate — Headline Numbers, May 9, 2026

*Generation-5 Information-Geometry Substrate · 16 USPTO Provisional Patents Filed*



Figure 1: Headline numbers as of May 9, 2026.

## What AQEA Is — Six Substrate Properties (P1–P6)

A structured representation space — a *substrate* — onto which any deterministic encoder’s output (transformer or classical signal-processing) projects. Six load-bearing properties, all empirically validated and patent-pending:

#	Property	Empirical anchor
P1	Multi-channel orthogonal organisation	$\Delta = 0.00$ pp spectral-orthogonality (exact)
P2	Byte-deterministic cross-platform encoding	26 / 26 tests across x86, ARM, Vulkan, Metal
P3	Structural compression with ranking preservation	23–29x compression, bit-identical Top-K
P4	Encoder-family-agnostic	13 domains x 6 transformer-foundations + 4 classical-DSP
P5	Noise-resistant ranking on raw signal-domain encoders	voraus-ad 133 % · Digit_Fall 174 % R-Ratio (Supra-Trit)
P6	Reversibly-decodable into 3 Pareto operating-modes	Audit 96.7 % · General 98.7 % · Pure 99.7–101.1 %

## Hard Facts

- **1.85x faster than Float-FAISS-GPU** at msmarco-passage 8.84 M docs on the same NVIDIA H100 — at **100 % Bit-Identity** to brute-force exact computation.
- **23x smaller index storage** (1.55 GB vs 36.0 GB at 8.84 M). A 100 M corpus that requires sharded multi-server FP32 fits in 16 GB on a single H100.
- **6.6x lower energy per query** on the CPU pipeline (AVX-512 / NEON, no AI-accelerator). Same hardware, same recall-tier, lower OpEx.
- **Cross-vendor by construction.** Single shader source compiles unchanged to NVIDIA Vulkan, Apple Metal, browser WebGPU, AMD ROCm — Bit-Identity verified across four backends.
- **13 / 13 cross-modal validations.** Six transformer foundations (BGE, WavLM, ESM-2, BiomedCLIP, codet5p, CLAP) + four classical signal-processing pipelines, same aqea\_bench binaries across all 13 domains, no per-modality code modifications.

## Reversibly-Decodable Substrate (P6) — Deployment-Time Mode-Dial

A trainable inverse-decoder reconstructs a float-representation from the substrate. Three operating-modes are empirically characterised — **the same substrate-encoded artefact serves all three modes without re-encoding:**

Mode	M1-cosine	R@K-Ratio	Suitable for
<b>Audit-Chain</b>	0.92	96.7 %	Compliance, regulatory audit, forensic reconstruction
<b>General-Purpose</b>	0.75	98.7 %	Mixed local-classification + audit deployment
<b>Pure-Retrieval</b>	0.66	99.7–101.1 %	Cold-storage similarity-search, retrieval-dominant fleets

The Pure-Retrieval mode at 100k-document scale measures **R@K-Ratio = 101.15 %** — the decoded ranking strictly *exceeds* the source substrate's direct ranking against the same ground-truth qrels (the *Supra-Trit* regime).

## 16-Application Patent Portfolio (filed May 9, 2026)

Track	Patents	USSN range	Subject
<b>A</b>	P1 / P2 / P3	64/061,725–727	Vector-Search Pipeline (GPU shader · CPU SIMD · Hardware roadmap)
<b>B</b>	C1 / C2 / C3 / C4	64/061,729–734	Audit-Proof Memory (multi-anchor · type-system · multi-scale · pre-inference)
<b>C</b>	M33	64/061,723	Master Substrate (foundational construction)
<b>D</b>	A1 / A2 / A3 / A4 / A5	64/061,736–743	Search Sub-Master (frozen-adapter · spectral · KG-engine · KG-embed · quantizer)
<b>E</b>	R1	64/061,749	Reversibility Master-Method
<b>F</b>	L1 / L2	64/061,751–752	LLM-Compression (TSE · combined encoding-stack)

Substrate-level patents (M33, A5, R1) apply across all substrate applications; application-level patents are specific to their respective domains. Engagement: NDA evaluation (4–6 wk), integration pilot (8–12 wk), or co-development. Full whitepaper (v5.0, ~30 pages, 17 figures) accompanies engagement.

**Contact.** NextX AG · <https://nextx.ch> · Sayed Amir Karim · [s.karim@nextx.ch](mailto:s.karim@nextx.ch) · USSN 64/061,723–752 · Customer Number 219394 · Filing Date May 9, 2026.