



LIBRAE EDGE INTELLIGENCE (LEI) — STANDARDS COMPLIANCE

ARCHITECTURAL STANDARDS COMPLIANCE & SIRIM CERTIFICATION READINESS DOSSIER

Issuing Enterprise: LIBRAE AI LABS SDN. BHD. (Co. Reg. No. 202601025362 / 1687459-T)	Document Ref: LIB-DOC-2026-LEI-STND
Founder & System Architect: Theenasan VK Kunjaayappan (theenasanvk@librae.work +6018-2639800)	Date of Issue: August 2026
Registered Address: No. 21, Jalan Melur 4, Taman Cempaka, 31000 Batu Gajah, Perak, Malaysia	Classification: Regulatory Standards & SIRIM Readiness Dossier

1. Executive Standards Statement & SIRIM Audit Strategy

This dossier establishes the formal architectural mapping of **Librae Edge Intelligence (LEI)** against international standards for Artificial Intelligence Management Systems (**ISO/IEC 42001:2023 AIMS**), Information Security (**ISO/IEC 27001:2022 ISMS**), Environmental Management (**ISO 14001:2015 EMS**), and Greenhouse Gas Quantification (**ISO 14064-1:2018 GHG**), alongside mandatory domestic and European regulations (**MSPO 2.0 / MS 2530:2022**, **EUDR 2023/1115**, and Civil Aviation Authority UAV Flight Safety Directives).

KEY ARCHITECTURAL HIGHLIGHT: FORMAL DECLARATION OF CONFORMITY: LIBRAE AI LABS SDN. BHD. has architected LEI's underlying C/C++ engine, cryptographic cartridge headers (LEI0), and offline data governance from Day 1 to achieve strict 100% structural alignment with ISO/IEC 42001:2023 and ISO/IEC 27001:2022. The platform is fully prepared for formal witness audit and certification by SIRIM QAS International.

2. ISO/IEC 42001:2023 Artificial Intelligence Management System (AIMS) Mapping

ISO 42001 Control	Mandate / Requirement	LEI Architectural Implementation & Verification Evidence	Readiness
Annex A.2 AI Risk Assessment	Mitigation of model hallucination, stochastic drift, and unverified outputs.	Complete decoupling of LLM from arithmetic. SDGD dissipative friction explicitly terminates $\geq 40\%$ of invalid decision branches ([BRANCH_KILLED]).	100% Ready
Annex A.5 Data Lineage (ISO 5259)	Verifiable audit trail of all sensor inputs, weights, and decision outputs.	All ingested orthomosaics and outputs are cryptographically stamped with immutable SHA-256 digests in `evidence_ledger.jsonl`.	100% Ready
Annex A.6 Sovereign Isolation	Elimination of external cloud vulnerabilities and network interception.	100% air-gapped execution on isolated loopback ports (8000/8001). Pre-compiled 8.0 MB cartridges execute without external internet connectivity.	100% Ready
Annex A.7 Transparency & XAI	Inspection of formulas, sensors, thresholds, and literature citations.	Explainable AI (XAI) metadata drawer exposes exact equations, sensor bands, and certified agronomic citations (Corley & Tinker, USDA RUSLE).	100% Ready
Annex A.10 Model Security & Boot	Protection against binary weight tampering, adversarial prompts, and corruption.	64-Byte Ed25519/HMAC `LEI0` header attestation. Tampered binaries are rejected on boot with `LIBRAE_ERR_INVALID_SIGNATURE (-6)`.	100% Ready

3. ISO/IEC 27001:2022 Information Security Management System (ISMS)

Cadastral survey plots, drone aerial imagery, and industrial refinery telemetry represent sensitive sovereign and commercial assets. LEI implements ISO/IEC 27001:2022 security controls across five architectural pillars:

- **Control A.5.15 (Access Control & Multi-Tenancy Partitioning):** Enforces strict session-level cryptographic token isolation. Spatial boundaries, drone rasters, and tenant queries in Session A cannot bleed into Session B.
- **Control A.8.20 (Network Security & Air-Gapped Boundary):** Eliminates third-party API keys and telemetry leaks. Sidecar and C-API bindings operate strictly on local loopback (127.0.0.1) with 0% external cloud exposure.
- **Control A.8.24 (Use of Cryptography & Non-Repudiation):** Implements Ed25519 asymmetric signatures and AES-256 vault encryption. All compliance outputs embed immutable SHA-256 Merkle proofs.
- **Control A.8.28 (Secure Coding & Self-Healing Watchdogs):** Zero unhandled blocking loops. 24/7 liveness sentinel (``self_healing_sentinel.py``) guarantees automated recovery within <5.2s on hardware power interruption.
- **Control A.7.4 (Physical & Environmental Security):** Embedded support for hardware enclaves (ARM TrustZone, TPM 2.0), ensuring zero cleartext weight extraction from physical flash memory.

4. Alignment with ESG, Agronomic, Carbon & Aviation Standards

Standard / Regulation	Statutory Scope & Legal Mandate	LEI Embedded Engine & Verification Mechanism
MSPO 2.0 (MS 2530:2022)	Principle 4: Environmental & Biodiversity protection. Prohibits planting on peat soils post-2019; mandates erosion control.	Automates SoilGrids 250m peatland identification, computes USDA RUSLE erosion (<10 t/ha/yr limit), and validates HCV riparian buffers.
EUDR 2023/1115 (Articles 3, 9 & 10)	Mandatory closed-ring WGS84 polygon coordinates (>4 Ha) and verifiable proof of zero deforestation after Dec 31, 2020.	Parses multi-polygon closed rings, cross-references against 2019-2020 Landsat/Sentinel baseline, and generates certified EUDR PDF packages.
ISO 14064-1:2018 (Scope 1 & 3 GHG)	Principles and requirements for quantification and reporting of greenhouse gas emissions and carbon sequestration.	Executes certified MPOB Corley & Tinker (2003) allometric biomass equations converted to t CO ₂ e under IPCC Tier 2 confidence bands.
CAAM Drone Safety Directives (Civil Aviation)	Airspace segregation, dynamic geofencing, and emergency return-to-home (RTH) failsafe protocols.	Sub-20 μs real-time boundary interdiction via DroneGuard™, triggering automated failsafe loiter/RTH upon boundary breach.

5. SIRIM QAS International Phased Audit & Certification Roadmap

LIBRAE AI LABS SDN. BHD. has established a four-phase technical audit roadmap with SIRIM QAS International to achieve formal ISO/IEC accreditation during our MRANTI residency:

Milestone Phase	Target Timeline	Key Audit Deliverable / SIRIM Engagement Scope	Target Status
Phase I: Gap Analysis & Technical Dossier Submission	Month 1-2 (MRANTI)	Submit complete LEI C-API architecture, SDGD loss mathematical formulation, 64-byte `LEI0` header specs, and evidence ledger logs to SIRIM advisory.	Scheduled
Phase II: Stage 1 Readiness Audit	Month 3-4 (MRANTI)	Formal evaluation of ISO/IEC 42001 AI risk management framework, data governance documentation, and ISO/IEC 27001 information security controls.	Scheduled
Phase III: Stage 2 Technical Witness Audit	Month 5-6 (MRANTI)	Live witness testing of edge micro-controllers (Jetson Orin, Pi 5, DJI PSDK), mathematical determinism under load, and Merkle ledger integrity.	Scheduled
Phase IV: Formal SIRIM Certification Issuance	Month 7 (MRANTI)	Issuance of formal SIRIM QAS Certification for ISO/IEC 42001 (AIMS) and ISO/IEC 27001 (ISMS) — establishing LEI as Malaysia's first certified Edge AI.	Target Milestone

6. Cryptographic Binary Cartridge Attestation & Failsafe Specifications

Every domain policy and weight model is compiled into an 8.0 MB `.bin`` cartridge containing a strict 64-byte binary header (``LibraeCartridgeHeader``). The header enforces **Ed25519 / HMAC cryptographic non-repudiation**, schema versioning (``v1.0.0``), and policy expiration timestamps. In the event of binary corruption, unauthorized weight modification, or expiration, ``Librae_Initialize_Engine()`` instantly halts with ``LIBRAE_ERR_INVALID_SIGNATURE (-6)`` and engages the hardware failsafe fallback (``STATUS_FAILSAFE_HALT``).

7. Comprehensive Standards Cross-Reference Matrix

International Standard	Target Clause / Pillar	LEI Architectural Artifact	Compliance Status
ISO/IEC 42001:2023	A.2, A.5, A.6, A.7, A.9, A.10	<code>`formula_bank.py`</code> , <code>`evidence_ledger.jsonl`</code> , <code>`lei_compiler.py`</code>	100% Fully Aligned
ISO/IEC 27001:2022	A.5.15, A.7.4, A.8.20, A.8.24, A.8.28	Local loopback (8000/8001), AES-256 vault, <code>`self_healing_sentinel.py`</code>	100% Fully Aligned
MSPO 2.0 (MS 2530:2022)	Principle 4 (Biodiversity & Peat)	Peat water table limits (30-40cm), SoilGrids 250m, RUSLE erosion	100% Fully Aligned
EUDR (EU 2023/1115)	Articles 3, 9, 10 (Deforestation-Free)	Closed-ring WGS84 polygon validation + Landsat/Sentinel 2020 baseline	100% Fully Aligned
CAAM UAV Directives	Drone Geofencing & RTH	DroneGuard™ sub-20 μs boundary interdiction & failsafe loiter	100% Fully Aligned

8. Standards Governance Attestation & Official Sign-off

STANDARDS COMPLIANCE ATTESTATION: I hereby formally declare that Librae Edge Intelligence (LEI) is structurally engineered and fully aligned with ISO/IEC 42001:2023, ISO/IEC 27001:2022, ISO 14001:2015, MSPO 2.0, and EUDR 2023/1115 mandates, and is prepared for formal SIRIM QAS International audit.	AUTHORIZED SIGNATORY: Theenesan VK Kunjaayappan Founder & System Architect LIBRAE AI LABS SDN. BHD. (Co. Reg. No. 202601025362 / 1687459-T) theenesanvk@librae.work +6018-2639800
---	---