MULTI-LAB TESTING PROCEDURES – UTRE FRAMEWORK

This document defines the multi-laboratory testing procedures for validating UTRE system metrics ($\Psi\blacksquare$, ΔM, $R(t)$) across independent facilities. The objective is reproducibility, transparency, and convergence across hardware (Illumination Chip, A.L.F.I.E.) and humanware (HRV/EEG coherence trials).

1. Test Site Requirements

• Minimum of three independent laboratories across geographically distributed sites.
• Each lab must meet shielding requirements (Faraday cage or EMI-controlled environment).
• Baseline calibration using reference signal generators and dummy loads.
• Preregistered protocols and IRB approval for human trials.

2. Experimental Design

• Each lab performs identical hardware and/or humanware experiments using shared definitions of $\Psi\blacksquare$, ΔM, $R(t)$.
• Minimum dataset: $10\blacksquare$ timestamped events for hardware trials, 30+ participants per human cohort.
• Sham controls: off-resonance frequency runs, randomized breathing protocols.
• All raw data, spectra, and coherence indices must be logged and time-synchronized.

3. Data Synchronization & Sharing

• Shared repository (Supabase/GitHub) with version-controlled datasets.
• Hashes (SHA256) for all uploads to ensure integrity.
• Metadata must include lab location, device calibration data, environmental logs, and operator notes.

4. Analysis and Replication

• Data from each lab analyzed independently, followed by meta-analysis.
• Effect sizes (Cohen's d, Cliff's δ) computed per lab and compared across sites.
• Convergence criteria: ΔM anomalies reproducible across ≥ 2 labs with $p < 0.05$ (Holm/BH corrected).

5. Reporting & Governance

• All results published with open-access preprints.
• UTRE Oversight Board reviews and certifies convergence events.
• Discrepancies trigger replication or design review.

6. Deliverables

• Raw time-series data (hardware + humanware).
• PSD curves, coherence indices, ΔM trajectories.

- Annotated analysis scripts and reproducibility notebooks.
- Final cross-lab meta-analysis report.