

The Three-Stage Laboratory Testing Blueprint

Stage	Physical Substrate	Measurement Tools	Expected Verification Metric
Stage 1: Short-Chain Oligonucleotides	Short, custom-ordered 100–200 bp synthetic DNA strands containing your exact prime-spaced G-C cluster matrices.	Single-Molecule FRET (smFRET) and Terahertz (THz) spectroscopy.	Measurement of a sharp drop in structural unfolding rates and enhanced mechanical stability when exposed to continuous vibrational noise.
Stage 2: Structural DNA Origami	Engineered DNA origami lattices folded into explicit 2D arrays that physically map out your finite prime sequence intervals.	Cryo-Atomic Force Microscopy (Cryo-AFM) and laser vibrometry.	High-fidelity mapping of the displacement transmission curve showing localized energy trapping (quantum/topological scarring).
Stage 3: Macro Metamaterial Analog	A scaled-up, bio-inspired 3D-printed acoustic metamaterial waveguide mimicking the exact mass-spring properties of your prime-spaced backbone.	Standard piezo-actuators and acoustic microphone arrays .	Physical observation of a macro-scale acoustic bandgap that eliminates vibration transmission in targeted sub-1000 Hz domains.