

Bio-Signal Synchronized Variable Electro-Optical Hybrid Skincare Device & Control Architecture

Next-Generation Resonance-Based Beauty-Tech Intellectual Property (IP)
Licensing, Direct Acquisition, and Strategic Joint Venture (JV) Co-Development
Program

Executive Overview: A breakthrough bio-convergence patent that dynamically synchronizes Electroporation (EP), Microcurrent (EMS), and Multi-wavelength Phototherapy (LED) with the user's real-time arterial hemodynamic pulse waveform (Systolic & Diastolic phases) to eliminate cellular adaptation and achieve 2x+ transdermal delivery efficiency at lower pain thresholds.

PROPOSING ENTITY	Tink Innovation
EXECUTIVE REPRESENTATIVE	Sungchu Kang, Chief Executive Officer
CORPORATE HEADQUARTERS	Seoul, Republic of Korea
DIRECT CONTACT	staping@naver.com
IP STATUS	KR Patent Application Filed PCT / Global Filing Preparation in Progress
DEVELOPMENT STAGE	System Architecture & Core Claims Established PoC & Co-Development Stage
TRANSACTION MODELS	Full IP Assignment / Global Licensing / Strategic JV & Joint R&D
DATE OF ISSUANCE	August 2026

SECTION 01 | EXECUTIVE OVERVIEW

Executive Summary & The Market Opportunity

1.1 Executive Summary

The global home-use beauty device industry is experiencing explosive growth, driven by consumer demand for clinical-grade dermatological treatments at home. However, first-generation devices face structural efficacy ceilings due to fixed-frequency, unilateral energy output. **Tink Innovation** introduces an essential paradigm shift: *Bio-Signal Synchronized Electro-Optical Hybrid Stimulation*.

By embedding dual Photoplethysmography (PPG) sensing and real-time hemodynamic phase-tracking algorithms into a handheld form factor, this patented architecture captures the user's microvascular cardiac cycle (Systole vs. Diastole) and delivers targeted electrical-optical energy strictly during the physiological *"Optimal Permeability Window."*

\$89.8 Billion

PROJECTED GLOBAL BEAUTY DEVICE MARKET (2030)

2.0x+ Efficacy

ESTIMATED TRANSDERMAL PERMEATION ENHANCEMENT

1.2 Industry Problem: The Fundamental Limitations of Conventional Devices

Current market-leading skincare devices (e.g., standard EMS rollers, static electroporation wands, static LED masks) operate blindly without feedback from the user's living tissue. This introduces two critical roadblocks:

Failure Mode	Biological Mechanism	Market Impact & Consumer Pain Point
1. Cellular Adaptation (Accommodative Decay)	Skin cells, peripheral nerves, and muscle tissues rapidly habituate to monotonous, static pulse trains within 3–5 minutes of continuous stimulation.	Long-term user satisfaction drops dramatically; consumers perceive diminishing returns after 2–4 weeks of purchase.
2. Hemodynamic Phase Mismatch	High-voltage EP or EMS delivered during the microvascular diastolic trough (when capillaries are constricted and cell gaps narrow) fails to penetrate.	Causes excessive epidermal stinging, thermal discomfort, and localized irritation without delivering active ingredients deep into the dermis.
3. Static Optical Irradiance	Continuous-wave LED illumination generates localized tissue saturation and photo-fatigue, limiting mitochondrial ATP synthesis.	Inefficient cellular rejuvenation, requiring lengthy treatment times (15–20 min) that lead to poor daily compliance.

Tink Innovation's Core Value Proposition

Our patented technology converts the user's heartbeat into a biological master clock, dynamically modulating electroporation peak voltage (V_{max}) and optical intensity (I_{max}) in real-time. This provides clinical-grade permeation and collagen stimulation with zero cellular habituation and substantially lower pain perception.

SECTION 02 | INTELLECTUAL PROPERTY PORTFOLIO

Patent Architecture & Legal Claim Scope

2.1 Patent Identification & Current Filing Status

Invention Title (Official)	Skin Care Device Providing Variable Complex Electro-Optical Hybrid Stimulation Based on Bio-Signal Synchronization and Method for Controlling the Same
Assignee / Proprietor	Tink Innovation (Representative: Sungchu Kang, Seoul, South Korea)
Jurisdiction & Status	Republic of Korea (KR) Patent Application Filed (Application Under Examination)
Global IP Strategy	PCT International Application in Active Preparation (Priority Right Claimable for US, EP, CN, JP, ASEAN)
Technical Classification	A61N 1/32 (Electromedical Therapy), A61N 5/06 (Phototherapy), A61B 5/024 (PPG Bio-Sensing)

2.2 Comprehensive Breakdown of Core Patent Claims

The patent is engineered with robust, defensive, and expansive claim structures designed to prevent competitor workarounds in hardware configuration, software algorithms, and physiological phase modulation.

Claim Tier	Protected Technical Scope	Strategic Commercial Enforceability
Claim 1 (Independent Hardware & System)	An integrated skincare device comprising: • Dual Bio-Signal Sensor: Contact-based PPG module measuring pulse/blood volume variations; • Hybrid Head: Multi-electrode array (EP/EMS) + multi-wavelength LED array (Red/IR/Blue); • Phase Controller: Real-time analyzer extracting Systolic (increasing blood flow) and Diastolic (decreasing blood flow) phases; • Modulation Driver: Dynamically linking electrical and optical outputs synchronously to detected biological phases.	Creates a dominant barrier to entry. Any handheld device synchronizing electrical/optical energy with real-time vascular PPG falls directly within this claim.
Claim 2 (Dependent - Systolic Control)	During the identified Systolic Time Window (T_{sys}): • Boosting Electroporation (EP) peak voltage to maximum (V_{max}); • Simultaneously driving LED optical irradiance to maximum intensity (I_{max}).	Monopolizes the "Peak Permeation Window" synchronization mechanism, preventing competitors from duplicating high-efficiency transdermal delivery.
Claim 3 (Dependent - Diastolic Control)	During the identified Diastolic Time Window (T_{dia}): • Switching electrical output to low-frequency muscle-toning microcurrent (EMS, V_{ems});	Protects the alternating "Active Delivery vs. Tissue Recovery" dual-mode cycle, which permanently prevents cellular habituation.

	• Attenuating LED output to low-power or pulsed recovery mode (I_{low}).	
Claim 4 (Dependent - HRV Intelligence)	Calculating real-time Heart Rate Variability (HRV) to categorize skin tension/stress index, and dynamically shifting base carrier frequency between 1 kHz and 10 kHz accordingly.	Establishes proprietary IP in personalized adaptive frequency tuning and stress-responsive smart dermatological care.

Technical Architecture & Mechanism of Action

3.1 Structural System Architecture (FIG. 1 Analysis)

The patented apparatus integrates high-precision bio-photonic sensors directly into the ergonomic operational flow of the device, capturing hemodynamics from two distinct peripheral contact points simultaneously.

Component Ref.	Hardware Designation	Functional Operation & Technical Specification
Ref 120	Handle Grip PPG Sensor (1st Detector)	Continuously measures peripheral blood volume variations and pulse waveforms directly from the user's palm/fingers upon gripping the device body (100).
Ref 130	Facial Contact PPG Sensor (2nd Detector)	Positioned flush within the hybrid stimulation head (110) to monitor facial dermal microcirculation (210) directly during skin contact (200).
Ref 112	Hybrid Electrode Elements (Anode / Cathode)	Bipolar / Multipolar conductive array delivering variable high-voltage electroporation pulses and low-frequency microcurrent waveforms.
Ref 114	Multi-Wavelength LED Emitters	Integrated solid-state optical emitters (Red 660nm for fibroblast activation, Near-Infrared 850nm for deep tissue regeneration, Blue 415nm for sterilization).
Ref 600	AI Phase-Predictive MCU Controller	High-speed microcontroller executing motion artifact cancellation algorithms and predictive systolic/diastolic timing calculation (>1 kHz sampling rate).

3.2 Physiological Mechanism: Dynamic Hemodynamic Phase Synchronization

Human dermal tissue is not static; it pulsates in sync with cardiovascular hemodynamics. Capillary pressure, interstitial fluid tension, and temporary micro-pores in lipid bilayers fluctuate between cardiac contraction and relaxation.

PHASE A: Systolic Phase (T_{sys})

Hemodynamic State: Ventricular ejection surges arterial blood flow; microvascular pressure peaks; epidermal intercellular spaces physically expand.

Synchronized Stimulus:

- **EP Energy:** Peak voltage V_{max} pulsed precisely at waveform peak.
- **LED Optical:** Maximum intensity I_{max} delivered simultaneously.

Clinical Result: Maximum active ingredient permeation through enlarged micro-channels + surge in mitochondrial ATP synthesis.

PHASE B: Diastolic Phase (T_{dia})

Hemodynamic State: Microvascular blood flow recedes; interstitial pressure normalizes; cellular membranes return to resting state.

Synchronized Stimulus:

- **EMS Current:** Automatic shift to mild microcurrent V_{ems} (muscle tone).
- **LED Optical:** Decay to low-energy pulse mode I_{low} .

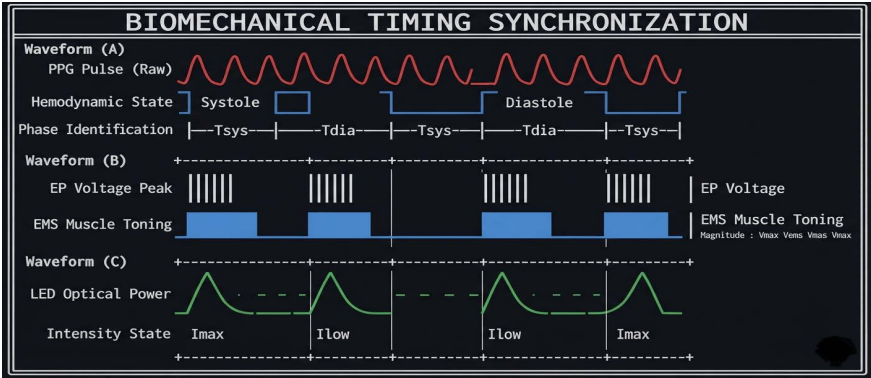
Clinical Result: Prevents cellular accommodation and thermal accumulation; promotes lymphatic drainage and facial contour lifting.

SECTION 04 | SIGNAL DYNAMICS & BENCHMARKING

Signal Synchronization Timing & Competitive Differentiation

4.1 Waveform Timing Architecture (FIG. 2 Analysis)

The core software logic patented under this IP continuously converts the analog PPG photodiode reading into discrete operational windows, creating a resonance effect with the living organism:



4.2 Competitive Benchmarking Matrix

A rigorous comparative evaluation against existing market leaders (e.g., APR Medicube Booster Pro, NuFACE Trinity, Ya-Man Photo PLUS) demonstrates Tink Innovation's decisive technical superiority:

Feature / Parameter	Conventional Devices (APR, Ya-Man, NuFACE)	Tink Innovation Patented Architecture	Strategic Commercial Advantage
Stimulation Timing	Fixed frequency (e.g., constant 500 Hz or 1 MHz) regardless of user biological state.	Dynamic Pulse Synchronization: Real-time phase lock with cardiac pulse cycle.	Eliminates energy wasted during biological refractory periods.
Cellular Habituation	High Risk: Skin habituates in 3-5 min; efficacy drops significantly with continuous use.	Zero Habituation: Natural biological heart rate variability dynamically modulates every pulse train.	Sustained clinical efficacy and superior long-term consumer retention.
Absorption Efficiency vs. Pain	High voltage needed for deep penetration, causing pain, erythema, and muscle spasms.	Low Average Voltage / High Peak Efficiency: Injects energy strictly during maximum cell expansion.	2x greater active cosmetic permeation with virtually painless application.
Smart Bio-Feedback	None or rudimentary skin impedance sensors (measuring dry vs. wet skin only).	Dual PPG + HRV Analysis: Adaptive 1 kHz–10 kHz carrier tuning based on user tension.	Enables true AI-personalized dermatological treatment programs.

SECTION 05 | DEVELOPMENT STATUS & VERIFICATION PLAN

Current Development Status & Co-Development Roadmap

5.1 Current Development Status: Concept & Architecture Established

Transparency Note: As of August 2026, Tink Innovation has secured and filed the comprehensive system architecture, claim formulations, circuit schematics, and timing synchronization logic under the Korean Intellectual Property Office (KIPO). The underlying hardware prototypes, analog front-end integration, and full-scale clinical trials are at the pre-development / co-development stage.

Why Early-Stage IP Represents Maximum Value for Strategic Partners

Acquiring or co-developing IP at this stage allows the purchasing enterprise or Joint Venture partner to **tailor the hardware industrial design, firmware algorithms, and clinical endpoints** directly to their proprietary product lines, cosmetic formulations, and regulatory targets (FDA Class II, CE MDR, KFDA) without inheriting locked engineering debt.

5.2 Structured 4-Phase R&D and Clinical Verification Plan

Tink Innovation has formulated a meticulous engineering and clinical verification pathway ready for execution with our prospective partner:

Phase	Engineering & Clinical Scope	Deliverables & Target KPIs	Timeline
Phase 1: Sensor & AFE Engineering	- Dual PPG sensor placement optimization; - Motion artifact reduction circuit design; - Analog Front-End (AFE) amplification & filtering.	- Functional Sensor PCB Prototype - PPG Signal Acquisition Rate: ≥95% under dynamic movement	Month 1 – 3
Phase 2: Firmware & AI Synchronization	- Real-time peak/valley extraction algorithm; - Predictive systolic window estimation; - HRV calculation & 1–10 kHz frequency tuning.	- MCU Embedded Firmware - Systolic Phase Prediction Accuracy: ≥98% (<1ms latency)	Month 3 – 5
Phase 3: Hybrid Drive Integration	- Dual EP/EMS variable pulse generator; - PWM-controlled multi-wavelength LED array; - Complete handheld ergonomic prototyping.	- Working Working Device Prototype (EVT/DVT) - Full Electrical Safety Compliance (IEC 60601-1)	Month 5 – 8
Phase 4: Comparative Clinical Trials	- Split-face clinical study vs. market leader; - Fluorescent active cosmetic penetration depth;	- Certified Clinical Trial Report - Absorption Depth/Speed: ≥1.5x–2.0x vs. Control	Month 8 – 11

	• Dermal elasticity & VAS pain scoring.	• Pain Score (VAS): >40% reduction	
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SECTION 06 | COMMERCIAL PARTNERSHIP MODELS

Patent Transfer, Licensing & Joint Venture Proposals

Tink Innovation offers flexible transaction and strategic partnership structures tailored to the strategic objectives, capital allocation, and commercialization timelines of global beauty-tech conglomerates, medical device manufacturers, and cosmetic enterprises.

Structure	Core Terms & Scope	Target Partner Profile & Strategic Fit
Model A: Outright IP Acquisition (Full Patent Assignment)	• 100% transfer of all patent ownership rights (KR Application + PCT Priority Rights); • Includes all architectural diagrams, algorithms, and engineering specifications; • Complete worldwide exclusivity with zero future royalty obligations.	Global Tier-1 Beauty & Device Brands seeking proprietary monopoly barriers and immediate IP fortification against competitors before international PCT entry.
Model B: Exclusive / Global Licensing Agreement	• Exclusive (or field-of-use exclusive) license for global or specific regional markets (North America, EU, Asia-Pacific); • Structure: Upfront Licensing Fee + Running Royalties per unit sold (e.g., 3.0%–5.5% of Net Sales); • Right of first refusal for future derivative patents.	Established Consumer Electronics & Skincare Companies seeking rapid product integration into existing manufacturing and retail distribution channels.
Model C: Strategic Joint Venture (JV) & Co-Development	• Formation of a dedicated Special Purpose JV Entity; • Tink Innovation: IP Contribution, core algorithm firmware, and technical architecture leadership; • Partner: R&D / Clinical financing, industrial manufacturing, global marketing, and brand distribution; • Shared equity, global commercial profit distribution, and co-ownership of derivative patents.	Cosmetic Conglomerates, Healthcare Funds, or OEM/ODM Powerhouses seeking high-synergy technological co-creation and explosive market leadership.

7.1 International PCT Expansion Strategy

Securing First-Mover Advantage across Worldwide Target Jurisdictions

Because the domestic application is freshly filed in the Republic of Korea, the prospective partner can actively participate in the **PCT (Patent Cooperation Treaty) filing process** to designate and enter national phases across key target markets:

- **United States (USPTO):** Securing the world's largest premium home-skincare device market.
- **European Union (EPO):** Capturing high-margin European dermatological luxury sectors.

- **China (CNIPA) & Japan (JPO):** Expanding across high-volume East Asian aesthetic beauty markets.
- **Southeast Asia (ASEAN / PCT):** Entering fast-growing emerging beauty-tech territories.

SECTION 07 | CORPORATE INFORMATION & NEXT STEPS

Proposing Entity, Next Steps & Governance

8.1 Corporate Background: Tink Innovation

Tink Innovation is an advanced technology innovation firm based in Seoul, Republic of Korea, dedicated to pioneering next-generation convergence between biological sensing, AI-driven algorithmic modulation, and cutting-edge dermatological hardware. Led by visionary entrepreneur and executive Sungchu Kang, Tink Innovation is focused on transforming static consumer electronics into interactive, bio-synchronized wellness ecosystems.

8.2 Immediate Engagement & Transaction Roadmap

Step 1: Mutual NDA	Execution of Bilateral Non-Disclosure Agreement (NDA) to facilitate deep technical exchange.
Step 2: Technical Deep-Dive	Comprehensive presentation of full patent specifications, claim dependency tree, and circuit block diagrams.
Step 3: Term Sheet Negotiation	Selection of preferred transaction model (IP Transfer, Exclusive License, or Strategic Joint Venture).
Step 4: Definitive Agreement	Finalization of contract, KIPO/PCT assignment filings, and commencement of Phase 1 R&D / Prototype engineering.

8.3 Official Contact Information & Representative Inquiries

For technical inquiries, patent transfer discussions, licensing evaluations, or Joint Venture term sheet proposals, please contact our executive management team directly:

Proposing Entity	Tink Innovation
Executive Representative	Sungchu Kang, Chief Executive Officer (CEO)
Direct Email Address	staping@naver.com
Corporate Address	Seoul, Republic of Korea
Primary Subject Line	[IP Inquiry] Bio-Signal Synchronized Skincare Device Patent Transfer / JV Proposal

"By bridging biological cardiovascular rhythms with precision energy delivery, Tink Innovation invites visionary global partners to co-lead the trillion-won smart aesthetic revolution."