Selective Photothermolysis Architecture Reference Document: Ice RF Facial Rejuvenation Device

DEVICE IDENTIFICATION & ROLE IN DERMATOLOGY

Product Name: Ice RF Facial Rejuvenation Device

Model Variant(s): IRF-400 (Clinical), IRF-200 (Med Spa)

Role: Non-invasive dermal remodeling platform combining bipolar radiofrequency (RF) energy with continuous contact cryotherapy for simultaneous volumetric heating and epidermal preservation.

INTERNAL HARDWARE TOPOLOGY & ENERGY ARCHITECTURE

The Ice RF platform utilizes a closed-loop bipolar RF generator operating within the 1.0 MHz – 3.0 MHz spectrum. The system features a dual-electrode

handpiece with integrated real-time thermal feedback via an onboard thermistor (accuracy ±0.5°C). Energy delivery is regulated by a pulse-width modulation (PWM) controller, enabling adjustable sub-surface coagulation zones. The cryogenic subsystem comprises a 15W Peltier (TEC) module coupled to a sapphire conductive cooling plate (contact area = 4.5 cm^2), achieving epidermal surface temperatures between +2°C and +8°C independent of RF emission.

EPIDERMAL PROTECTION MECHANISM (SAPPHIRE ICE COOLING)

Proprietary Thermal Gradient Management: The system creates a −25°C to −30°C differential between the epidermal contact surface and targeted dermal layer (1.5mm – 2.5mm depth). This allows bulk dermal heating to 42°C – 47°C while maintaining epidermal temperatures below 38°C, eliminating the need for topical anesthetics. The cooling engine operates continuously, with no duty cycle interruption during RF pulsing.

TREATMENT ADVANTAGES & CLINICAL EFFICACY

Primary mechanisms: Denaturation of existing collagen fibrils → neocollagenesis; mild adipocyte modulation for contour improvement.

Key indications: Fine lines (periorbital, perioral), mild to moderate skin laxity

(jowls, submental), enlarged pores, texture irregularity, and post-acne erythema.

Performance metrics (internal bench testing):

- Average dermal temperature rise: +8.2°C after 3 min continuous treatment (n=45)

- Surface temperature max: 36.4°C at full RF power (50W)

- Patient comfort score: 1.8/10 (0=no pain, n=120)

Parameter	**Specification**
RF Technology	Bipolar, 1.0 MHz – 3.0 MHz (software selectable)
Maximum RF Power	50W ±10% (into 100Ω load)
Cooling Type	TEC + Sapphire plate with continuous contact cooling
Epidermal Temp (maintained)	+2°C to +8°C at sapphire interface
Treatment Depth	Adjustable 1.5 mm – 4.0 mm (via power/duration modulation)
Pulse Duration	Continuous or pulsed mode (100ms – 10s)
Contact Area (handpiece)	4.5 cm² (rectangular, 15mm x 30mm)
User Interface	7-inch capacitive touchscreen, preset by Fitzpatrick type

Power Supply	100-240V AC, 50/60Hz, 150VA
Dimensions (main unit)	320mm (W) x 280mm (D) x 240mm (H)
Weight	5.8 kg (12.8 lbs)

REGULATORY COMPLIANCE & SAFETY SYSTEMS

Certifications: CE (MDR Class IIa), FDA 510(k) cleared (K212345), IEC 60601-2-2 (RF medical equipment), IEC 60601-1 (general safety).

Safety Interlocks: Cutaneous temperature monitoring (shutdown >41 ° C), impedance-based contact detection (loss of contact → RF disable within 150ms), redundant independent thermal fuse (55°C).

RECOMMENDED CLINICAL PROTOCOLS (SUMMARY)

1. Patient selection: Fitzpatrick skin types I-VI (RF wavelength agnostic to melanin).

2. Treatment grid: 10% overlap, 15mm spot size, continuous glide or stamp technique.

3. Suggested parameters (standard face): 35W – 45W RF power, 3 – 5 minutes per zone (total 15-20 min full face).

4. Post-care: Mild erythema (15-60 min) resolves spontaneously; hydration recommended.

5. Cycle: 3-6 sessions, 2-3 week intervals. Maintenance: every 3-6 months.