PROJECT DOSSIER: PASSIVE RESCUE RADIO SYSTEM (PRRS)

A Z-Lab Non-Commercial R&D Initiative

I. EXECUTIVE SUMMARY

The **Passive Rescue Radio System (PRRS)** is a zero-power, life-saving communication framework designed for extreme disaster scenarios. By leveraging the principles of passive resonant cavities and non-linear harmonic backscatter, the project removes the dependency on batteries or active electronics for victims, shifting the energy and processing burden entirely to the rescue forces.

II. CORE MISSION & NON-COMMERCIAL STATUS

Objective: To provide a failsafe signaling method for victims trapped in floods, landslides, or collapsed structures.

Z-Lab Commitment: This is a non-commercial project intended for humanitarian aid. All technical blueprints and protocols are developed for open-source implementation by global NGOs and government emergency response units.

III. TECHNICAL PILLARS (Z-LAB SPECIFICATIONS)

1. The Passive Wristband (End-User Device)

- **RF Mechanism:** A flexible **Spiral Slot Antenna Array** integrated into a Polyimide substrate (1.5 GHz L-band).
- **Acoustic Modulation:** A polarized **PVDF (Polyvinylidene Fluoride)** thin film that modulates the antenna's impedance based on sound pressure (human voice).
- **Deep-Recovery Node:** An integrated **Zero-bias Schottky Diode** that enables 2nd harmonic backscatter (2f) for detection through up to 20 meters of debris or soil.

2. The Integrated Rescue Infrastructure

- **Airborne Tier (UAV/Helicopter):** Equipped with high-power RF illuminators and real-time audio demodulators to "hear" victims from the air.
- **Ground Tier (Search & Recovery):** Specialized **Non-Linear Junction Detectors (NLJD)** designed to pinpoint victims buried deep underground where traditional signals fail.

IV. OPERATIONAL ESCALATION MATRIX

Level	Scenario	Signal Mechanism	Effective Range/Depth
Tier 1	Surface Floods / Isolation	RF Backscatter & Voice Modulation	2 - 5 km (Line of Sight)
Tier 2	Mudslides / Light Debris	Forced Morse Code (Manual Override)	500m (Aerial Detection)
Tier 3	Deep Burial / Recovery	2nd Harmonic Reflection (2f)	10 - 20m (Sub-surface)

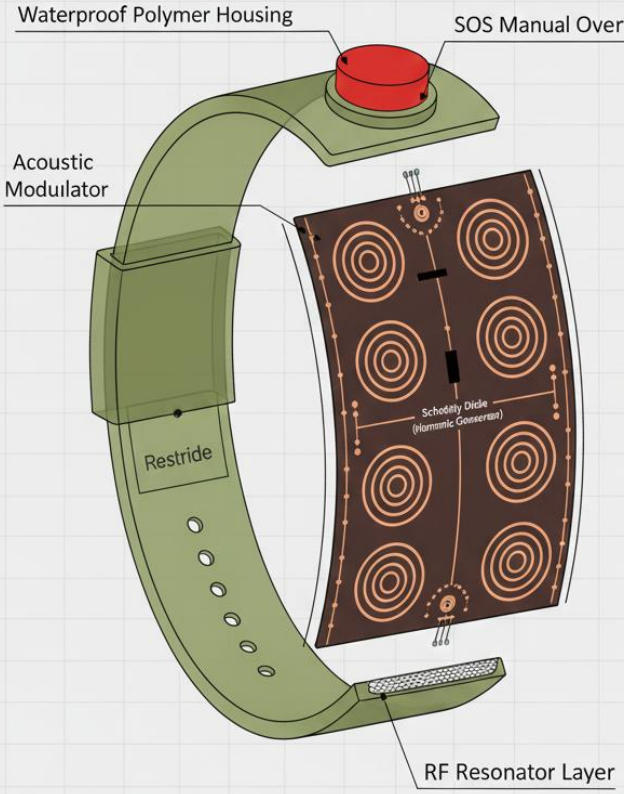
V. MANUFACTURING & DEPLOYMENT BLUEPRINT

- **Zero-Battery Architecture:** Ensures infinite shelf life and zero chemical leakage into disaster-stricken environments.
- **Low-Cost Scalability:** Manufactured via **Flexible Hybrid Electronics (FHE)** and Silicone molding. Estimated material cost: < $2.00 USD per unit.
- **Environmental Resilience:** IP68+ waterproof rating, shock-resistant, and functional under extreme pressure.

VI. INTEROPERABILITY PROTOCOL

- The PRRS operates on a standardized frequency allocation to ensure coordination between diverse rescue assets:
- **Illumination Frequency:** 1.575 GHz (Primary) / 900 MHz (Deep Search).
- **Return Signal:** Modulated carrier (Voice) / 1.8 \GHz (Harmonic Recovery).

Project Status: R&D Framework Finalized.
Lab: Z-Lab Internal Prototype.
Licensing: Open Humanitarian License (Non-Commercial).



Technical Specifications
Frequency: 1.575 GHz
Bandwish: 3.4 kHZ (Voice)

Materials: Copper, Silicone, PVD, Polyimid
Durabiity: IP68+

System Operational Model

Rescue Chopper (RF Source) →
Carrier Wave
Wristband
Modulated Backscater Signal
Demodulator

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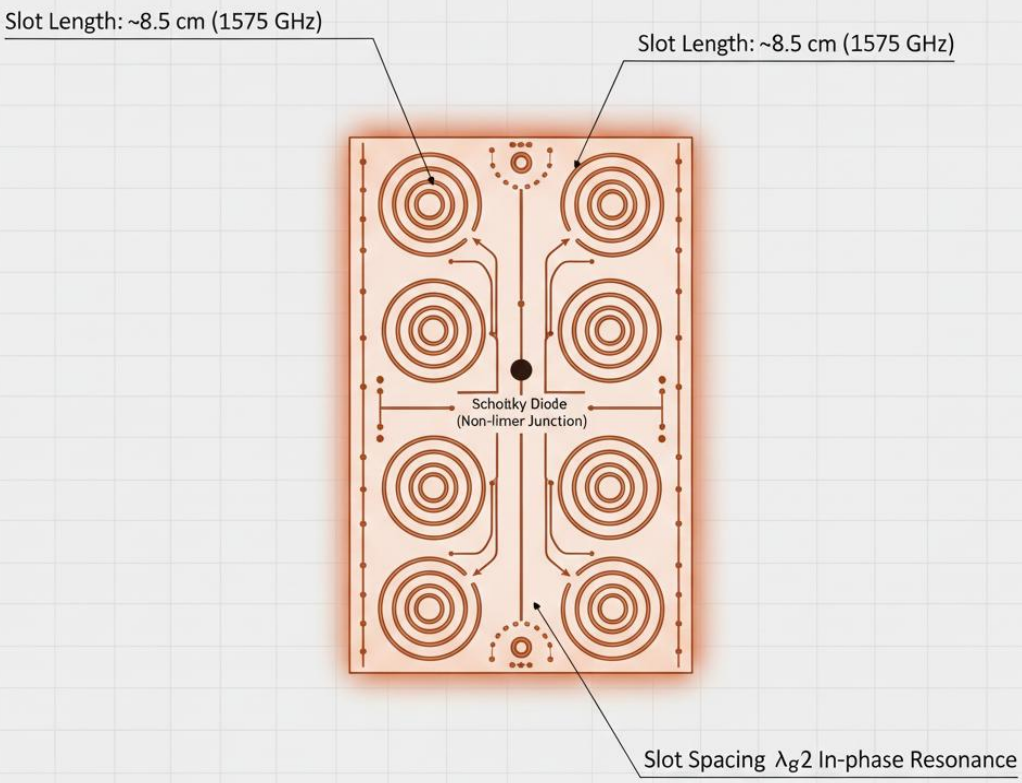
360° Slot Array Blueprint



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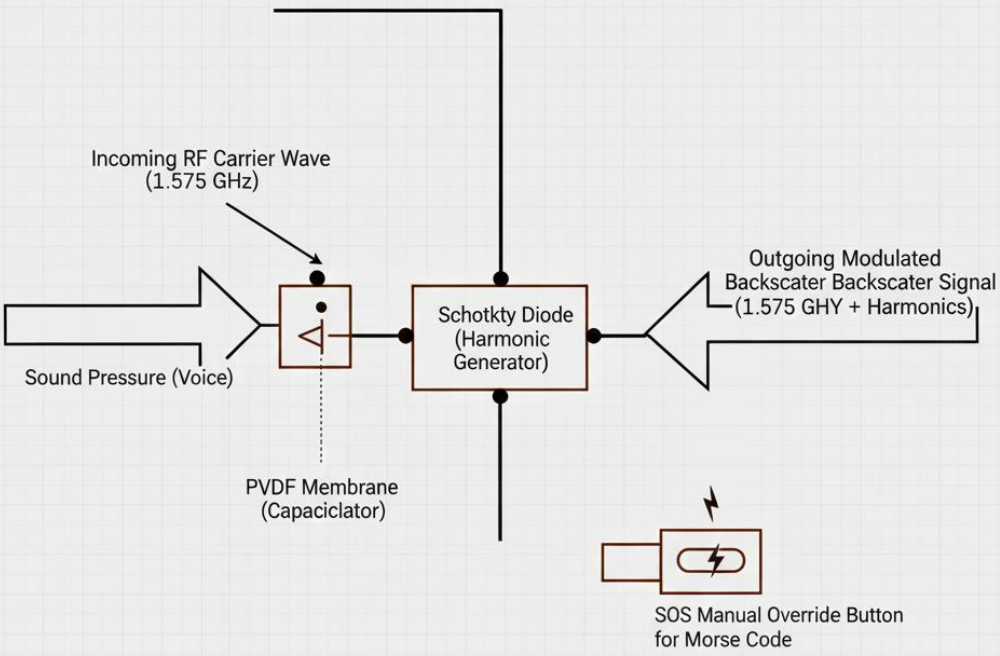
Modulation Circuit Schematic



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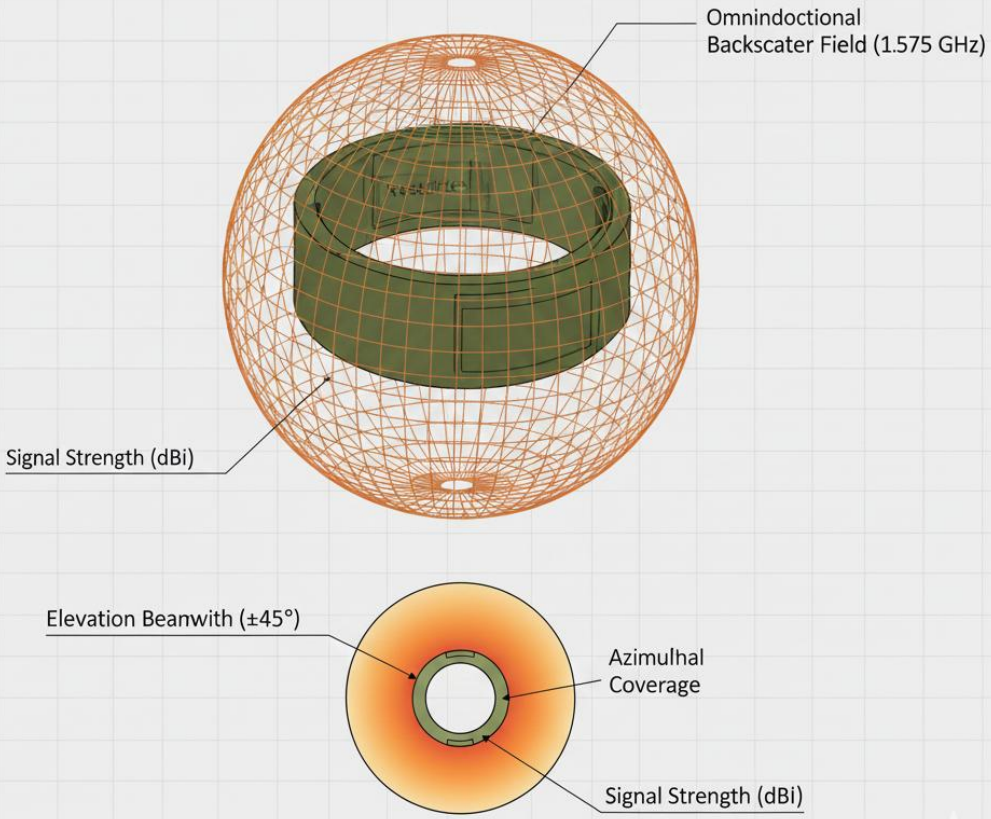
76 7: 3D Radiation Pattern Simulation



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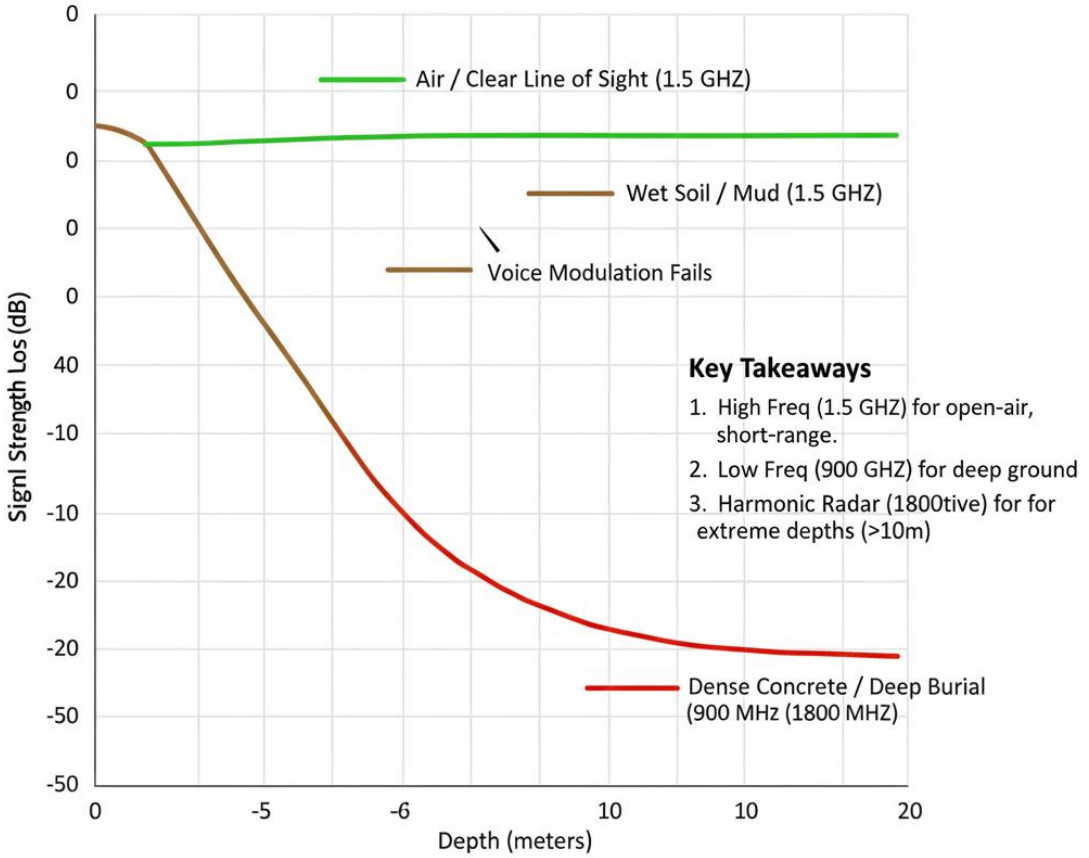
5/8: RF Signal Attemation Curves



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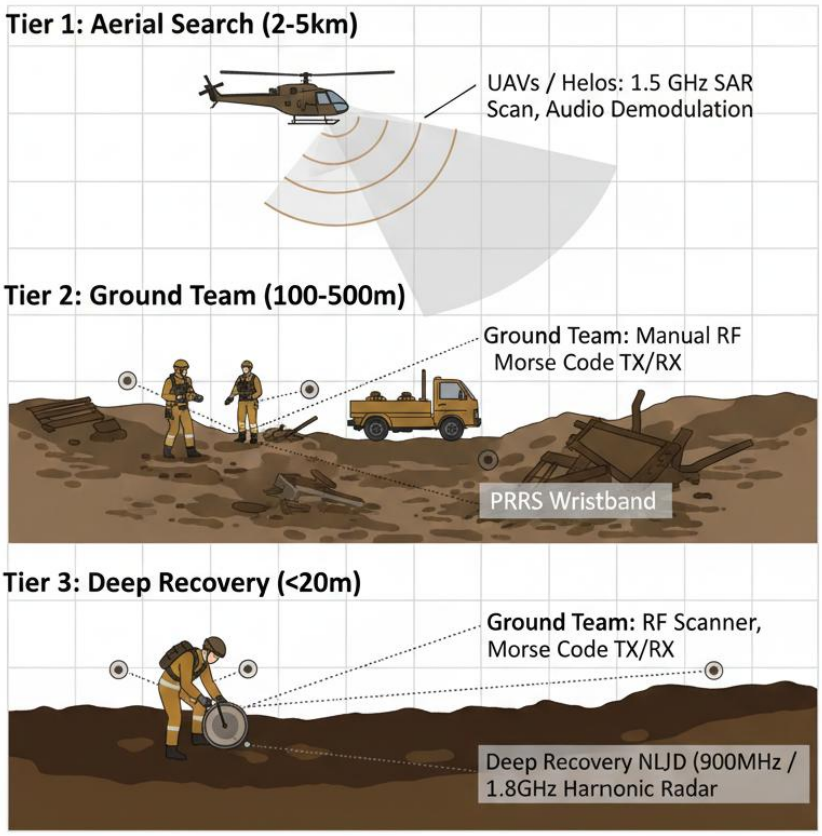
6/8: Multi-tier Coordination Map



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7/8: Rescue Scanner UI

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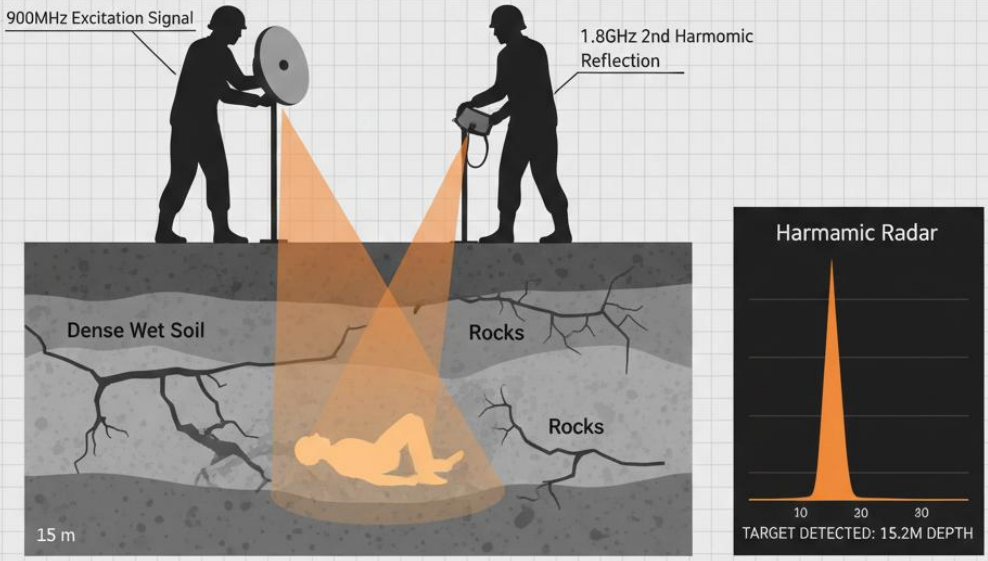
8/8: Deep Recovery NLJD Simulation



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