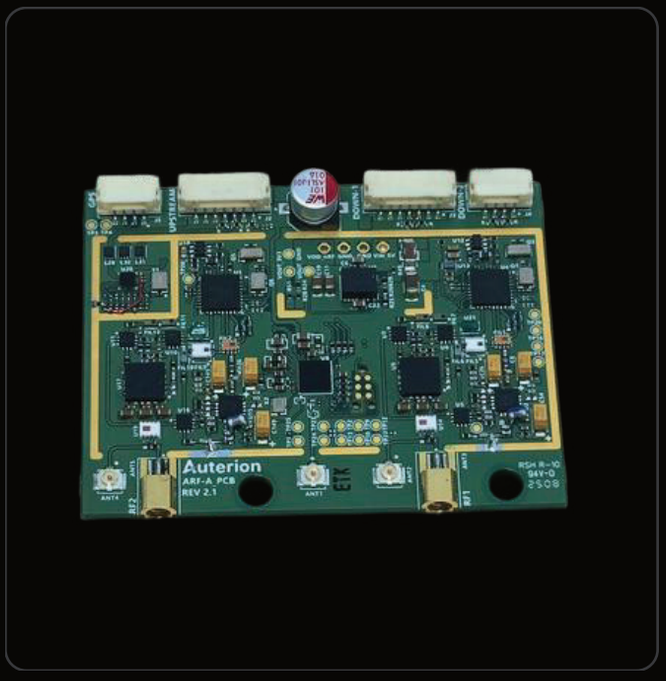
Auterion Radio Framework

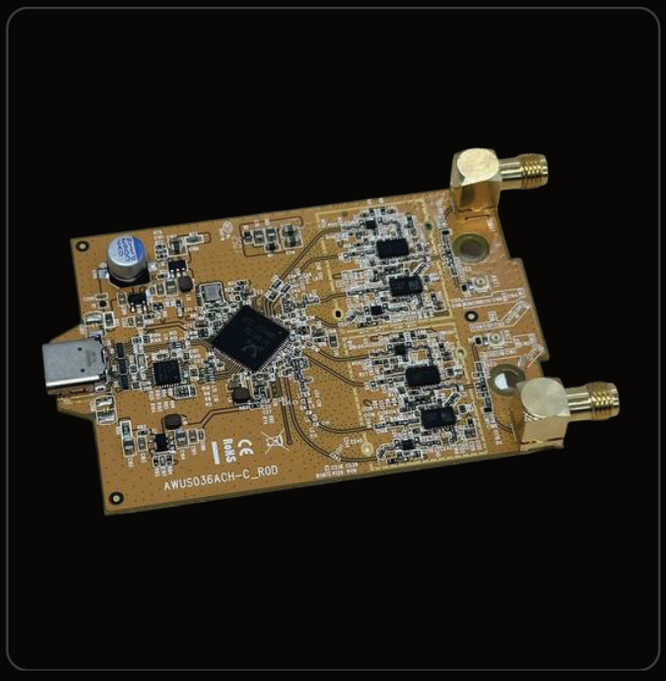
The Auterion Radio Framework (ARF) is a comprehensive solution space for radio frequency technologies in autonomous robotics. It provides scalable, flexible, and cost-effective data links and GNSS-denied localization solutions for drone operations through a combination of software and hardware components.

ARF offers a SWaP-C space which allows integrators both high-performance and high-value options to fit the needs of the platform's end-use-case. Auterion leverages the ARF to create TRL9 reference systems that can be built at mass scale to maintain potency over time.

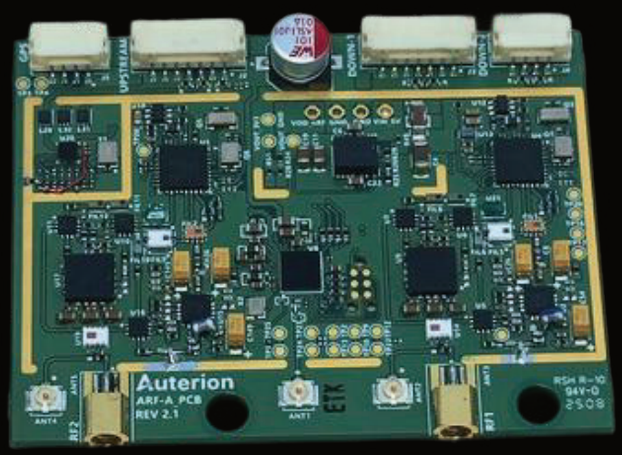
Developed in response to market limitations, the ARF reduces overall solution cost, eliminates dependencies on external vendors, and allows for software-defined performance enhancements over time.

ARF allows Auterion to maintain supply chain flexibility and adapt to emerging battlefield requirements, particularly in contested environments like Ukraine where traditional commercial solutions may be insufficient or too expensive.





ARF-A Overview



ARF-A is a versatile, low-cost, long-range companion packet radio designed for long-range communications and precise positioning in advanced drone operations. It supports flexible telemetry transmission in both bidirectional and unidirectional modes, with high output power and comprehensive software control.

ARF-A is resilient to jamming with forward error correction, pure broadcast modes, frequency hopping, redundant comms and concurrent multi-band operation. It is positioned as a low data-rate companion (<= 90kbps) to other radios in the framework which are more appropriate for video transmission, though ARF-A can be adapted for low-rate transmission of images. ARF-A includes significant RF filtering to allow for colocation of other ARF radios on small systems and to prevent out-of-band jammers from causing de-sense.

With its long-range communication capability, ARF-A is ideal for military, tactical, and advanced drone applications. A standout feature is its integration of time-of-flight ranging, which allows multiple radios to determine their relative positions and facilitates GPS-denied navigation or unit-to-unit homing in target hand-off or on-station transfer applications.

The system's architecture is designed for hardware revisions to meet various regulatory standards. Additionally, the software-defined nature of the radio at the link-layer level allows for continuous improvements via updates, making it adaptable to evolving mission requirements.

ARF-A Details

Capabilities

- Capable of 100km+ Command / Control / IP Traffic with modest ground-station gain
- Fully redundant dual RF chain, each capable of operating at either band
- MCUBoot based firmware updates
- GPS-Denied Ranging
- Frequency Hopping / Jamming Immunity
- AES-256 Secure Comms
- Multi-band concurrent comms
- Standalone ranging / beacon modes with NMEA/UBX inputs
- Standalone relays / mesh forwarding / multicast
- One-touch instant configuration via YAML

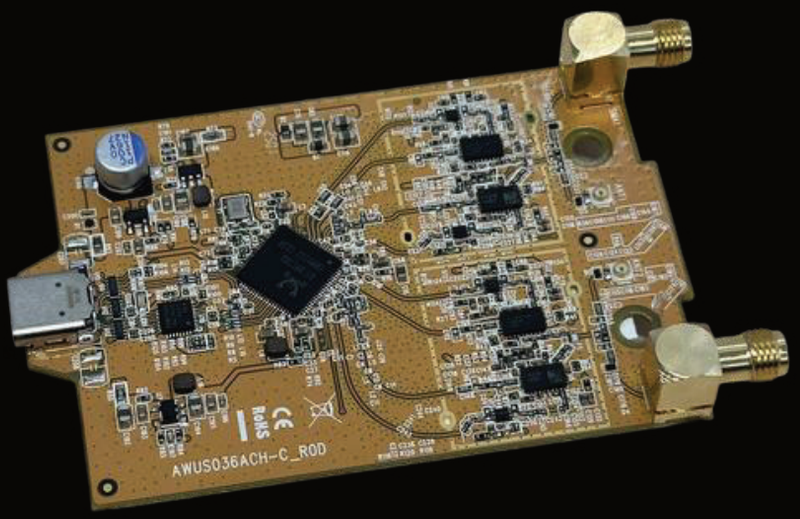
Key Features

- Supports time of flight range, enabling GPS-denied navigation.
- Configurable multi-band operation allows for redundant comms and distinct bands for uplink/downlink.
- Bidirectional communication (both uplink and downlink on a single band).
- High output power with software-controlled adjustments.
- Software-defined features allow updates, including spectrum scanning and dynamic behavior changes.
- Software-defined features allow updates, including spectrum scanning and dynamic behavior changes.
- Built to work in electronic warfare (EW) conditions.
- Standalone relay / repeater modes

Specs

- USB IP networking (RNDIS or CDC-NCM)
- Time-to-transmit from power-off <5 seconds
- Built-in USB hub that allows daisy-chaining and coexistence with ARF-B
- Up to 35 dBm out
- 5V input
- Two redundant RF Chains:
  - Low-band: 760-960 MHz
  - High Band: 1900 - 2200 MHz
- High out-of-band RF rejection

ARF-B Overview



ARF-B is a cost-effective video and telemetry transmission solution built on top of mass-market 802.11 baseband hardware adapted for use in areas with active EW via software-defined behavior. ARF-B offers reliable performance in contested environments through frequency hopping, time synchronization not reliant on GNSS/PNT, and tightly controlled resource block timing. The system delivers video transmission and C2 capabilities over distances of 20-30 kilometers, with range varying based on ground station setup.

ARF-B's approach to frequency hopping and resource block technology provides resistance to jamming, and its physical transmission properties ensure continued operation even when facing active jamming at the drone. Uplink resource blocks are transmitted within the first mS of the hopping time-slot which allow for hunt-and-peck jammers to coexist with ARF-B without impacting uplink performance. ARF-B is designed for military operations, but it can be enabled to different operational environments through software configurations. ARF-B primarily operates across the 4.9-6 GHz band, but can be configured to operate within CE / FCC bounds via dynamic software configuration.

ARF-B Details

Capabilities

- Modified Wi-Fi chipset for enhanced broadcasting
- Range: 20–30 km depending on ground control station
- Frequency hopping enhances resistance to jamming.
- Unidirectional transmission prevents interference at the receiving end.
- Cost effective for attritable assets

Key Features

- Bi-directional broadcast comms with forward error correction
- Frequency Hopping
- Multi-band concurrent comms when paired with other ARF radios
- Standalone relays

Specs

- Up to 30 dBm out
- 20 MHz bandwidth operation
- 5V operation
- USB comms
- 1.1 GHz of useable bandwidth
  - 4.9-6 GHz