

RadioOps RF Tracking Training Guide

RadioOps RDF Tracker • Version 1.2.0

v1.2.0 APPLICATION UPDATE

- This guide is aligned with the RadioOps RDF Tracker v1.2.0 production release.
- Production operational map: <https://radioops.org>
- Practice and Live operations are separated. Live operation state is server-authoritative and is explicitly started and ended by NCS; a server restart does not automatically start a Live operation.
- Each Live operation has a unique Operation ID. Save Map records the operation state; Load Map replaces the current map with the saved state rather than adding to it.
- TX1/TX2/TX3 lines and markers follow the current operational visibility state. The map normally synchronizes about every 3 seconds.
- If a client loses connectivity, wait for resynchronization and verify the current operation/map state before entering additional observations.
- NCS controls operation start/end, map management, and team-slot administration. Teams submit observations through their own claimed slot; NCS controls TX context as required.
- Mobile marker support is implemented in v1.2.0; final real-device iPhone Safari verification remains a field-test item.

Current Training Procedure

1. Purpose

This guide establishes the field procedures for locating both mobile and stationary RF transmissions using RadioOps, field mapping tools, cell phones, directional antennas, omni antennas, and TinySA spectrum analyzers.

The operation is divided into two phases:

Tracking: Establishing the location and movement of the RF source. Close-In Search: Transitioning from directional RDF to close-range signal hunting. Net Control (NCS) maintains the overall operational picture and directs team movement.

2. Mobile RF Tracking

Team Structure

Mobile RF operations use two groups:

Hunters

Hunters establish and maintain the perimeter around the suspected operating area. Their primary job is to track the movement of the RF source rather than chase it.

Hunters:

Remain distributed around the operating area. Take bearings at approximately 15-minute intervals. Report bearings and significant observations to NCS. Remain in position unless directed otherwise. Report significant changes in the apparent direction or movement of the source immediately. Use the RadioOps map to provide NCS with current bearing information.

Dogs

Dog Teams are the pursuit and close-in teams.

Dogs:

Remain available for deployment. Move when directed by NCS. Enter the developing search area. Obtain closer bearings as they approach the source. Transition through the close-in antenna procedures. Conduct the final search for the transmitter.
Mobile Source Tracking

The basic procedure is:

Hunters establish the perimeter → Hunters take periodic bearings → NCS determines movement → NCS directs Dogs → Dogs close on the source. A mobile source should generally not be chased immediately by every available team. The Hunters provide the information needed to determine where the source is going. The Dogs provide the ability to close on it.

3. Hunter Procedure

When a mobile source is being tracked:

- 1. Move to the assigned observation position.**
- 2. Establish the strongest consistent bearing available.**
- 3. Enter the bearing into the RadioOps map.**
- 4. Report the bearing to NCS.**
- 5. Remain in position when practical.**
- 6. Retake the bearing approximately every 15 minutes.**
- 7. Report any significant change immediately.**
- 8. Continue until NCS changes the team's assignment.**

The objective is to create a series of observations that allows NCS to determine the source's movement. Hunters should avoid unnecessary movement unless directed by NCS.

4. Dog Team Deployment

NCS uses the Hunter bearings and RadioOps map to determine where the source is moving. When sufficient information is available, NCS assigns one or more Dog Teams to the developing search area.

The Dog Team then progresses through three stages:

Directional Antenna → Omni Antenna → No Antenna Each stage has a different purpose.

5. Dog Team — Directional Antenna

Purpose

The directional antenna is used to establish direction while the Dog Team is approaching the source. TinySA Setup Input: LOW Frequency: Known transmission frequency Span: Approximately 100 kHz RBW: Auto or approximately 10 kHz Marker: Max Search Antenna: Directional Yagi Attenuation: Adjust as signal strength increases Sweep the Yagi through the suspected area and identify the strongest consistent signal. The Dog Team reports directional bearings to NCS.

Communications

While using the directional antenna:

NCS remains the primary communications path.

The Dog Team should report:

Bearing Location Signal observations Significant changes Problems or unusual conditions NCS uses these reports to maintain the operational picture and direct the Dog Team. The Dog Team should not unnecessarily coordinate its movement with other Dogs while conducting directional work unless NCS directs it.

6. Dog Team — Omni Antenna

Transition

The Dog Team changes from the directional antenna to the omni antenna when it has entered the close search area and the directional antenna is no longer providing a useful advantage. Yagi → Omni The purpose now changes from finding a bearing to finding the strongest area.

Procedure

- 1. Stop at a fixed position.**

- 2. Observe the signal level.**
- 3. Move several feet.**
- 4. Compare the signal level.**
- 5. Repeat from different positions.**
- 6. Look for a consistent increase in signal strength as the team approaches the source.**
- 7. Use buildings, terrain, vehicles, and other objects as possible reference points.**

Do not assume that the strongest instantaneous reading represents the source. Reflections and multipath can produce misleading peaks. Look for a repeatable signal-strength gradient.

Communications

Once operating with the omni antenna:

Dog Teams may communicate directly with other Dog Teams.

They may:

Compare signal observations. Coordinate movement. Compare locations. Help one another narrow the search area. NCS remains responsible for overall coordination and should continue receiving significant findings.

7. Dog Team — No Antenna

Purpose

The no-antenna stage is the final close-in search. Omni → No Antenna Remove the antenna from the TinySA. The instrument is now being used primarily as a very short-range proximity indicator, rather than as a conventional RDF receiver.

Procedure

Move slowly through the suspected source area. Watch for repeatable changes in signal level.

Check:

Different sides of buildings Around vehicles Ground level Bushes and other concealment Objects that could contain or hide a transmitter Do not rely on a specific dBm reading as a fixed distance measurement. Signal level varies with transmitter power, reflections, terrain, and surrounding objects. The objective is to locate the area producing the strongest repeatable response.

Communications

At this stage:

Dog Teams may communicate directly with other Dog Teams as necessary. Teams can coordinate the final search without waiting for every movement to be directed by NCS. Significant findings are still reported to NCS.

8. Overload

As the Dog Team approaches a strong transmitter, the TinySA may become overloaded. If the signal is driven against the top of the display or becomes distorted: Stop moving closer. Increase attenuation and verify that the signal can be displayed normally before continuing. The objective is to maintain a usable measurement rather than simply obtaining the largest possible signal on the screen.

9. Stationary RF Source

Stationary RF operations use a different team structure. There is initially no permanent Hunter/Dog separation. All teams are available to establish the perimeter and obtain bearings.

Initial Phase

Teams spread throughout the operating area. For a stationary source, teams should generally move approximately 1–10 miles to obtain useful separation between observations, depending on terrain, roads, and the operating area.

Each team:

- 1. Establishes its position.**
- 2. Obtains a bearing.**
- 3. Reports the bearing to NCS.**
- 4. Plots or provides the information through RadioOps.**
- 5. Moves as directed if additional bearing separation is required.**

NCS uses the combined bearings to establish the probable source area.

10. Perimeter Collapse

Once NCS has established a sufficiently defined search area, the perimeter collapses.

At this point:

Hunters become Dog Teams. There is no longer a reason to maintain the outer perimeter. All available teams transition into the Dog Team procedure.

The teams progressively move from:

Long-range RDF → Directional → Omni → No Antenna The same close-in procedures used for a mobile source now apply.

11. Stationary Source — Dog Team Transition

Once the perimeter collapses:

Phase 1 — Directional Teams move toward the established search area using directional antennas. Teams report bearings to NCS. Phase 2 — Omni As teams enter the close search area, they transition to omni antennas. Dog Teams may now communicate directly with one another to compare observations and coordinate their movements. Phase 3 — No Antenna When teams reach the final search area, they transition to no-antenna operation. Teams coordinate the final search while keeping NCS informed of significant findings.

12. Operational Rules

Mobile Source Hunters track. Dogs pursue. NCS coordinates. Hunters remain on the perimeter and take periodic bearings. Dogs move toward the developing source location when directed by NCS. Stationary Source Everyone hunts. Perimeter collapses. Everyone becomes Dogs. Teams establish the initial bearing picture. Once NCS has a sufficiently defined search area, the perimeter collapses and all teams transition into the Dog Team close-in procedure.

13. The Simple Field Rule

Mobile RF:

Hunters stay on the perimeter. Dogs move toward the source. Hunters report approximately every 15 minutes. NCS directs the Dogs.

Stationary RF:

Teams establish the perimeter. NCS identifies the search area. The perimeter collapses. Hunters become Dogs.

Dog progression:

Yagi → Omni → No Antenna Yagi: NCS-directed directional work. Omni: Dog Teams may coordinate with each other. No antenna: Close-in team search with direct Dog-to-Dog coordination while NCS maintains overall control.

14. RadioOps Tools

The operational map is provided through radioops.org. Teams use their cell phone and RadioOps map tools for location, bearing information, and coordination with NCS. The map is the shared operational picture. NCS maintains the overall picture while field teams provide current observations from their locations.