

Radio Direction Finding Primer

Purpose of RDF/radiolocation:

- Establish the heading (and possibly rough distance) of transmitter
- Using triangulation, establish exact location of a transmitter

Uses

- Finding harmful interference
 - Malicious jammers (or not so malicious – e.g. business band co-users)
 - stuck transmitters / malfunctioning equipment
 - local RF noise sources
 - spies :-)
- Search & Rescue
 - Distress beacons (ELT/PLB/EPIRB)
 - radio user (e.g. ham/CB/MURS/GMRS/FRS)
 - lost radio (aural vs. cross-band repeat)
 - wildlife tracking
- Sport
 - Size / type
 - short-range - hiking, enjoying the “great outdoors”
 - regional - driving
 - world-wide – cooperation
 - single transmitter or “course” - minimize distance traveled to find all
 - fixed / mobile fox + auto / human
 - Benefits
 - No need for a license!
 - Physical & mental exercise
 - can be cheap
 - build your own equipment

Characteristics of an ideal RDF system:

(whether “system” is a \$1M set of equipment, or just you & a \$30 HT)

- Accurate (provides exact direction/location)
- Fast (single reading gives instant location)
- Easy to use
- Works on any frequency
- 3-D location (long-range HF)
- Sensitive to weak signals
- Immune to:
 - strong signal overload
 - adjacent-channel (or even co-channel) interference
 - polarization changes
 - multi-path interference

Transmitter equipment

- Needs to ID
- Constant amplitude/frequency wave easier
- turn on remotely makes easier to hide while being watched
- Cheap option:
 - broken \$30 chinese HT set for VOX
 - \$10 MP3 player looping custom track through earbud over mic on radio
 - rubber band + ziploc bag

Receiver Methods

Different methods depending on distance/band (raw sig strength better close-in)

- **Signal strength: Directional Antennas** (1 or more @ diff az.)
 - Remember: transmitter may be directional too
- Frequency: Doppler (rotate receiver around a point) bad for FM, horz. Pol.
- Time/phase: arrays
 - older: Interferometer - phase comparator
 - newer: Sensor arrays & DSP measure time

Signal Strength Indication

S-meter, tone-pitch S-meter, quieting

Band Differences

2m vs. 70cm vs. 80m

Directional antenna tips

- Yagi: Use null, not max gain direction
- Don't trust reflections - move! Signal strength from multiple locations is more reliable than orientation @ a single spot.

Making an omnidirectional receiver directional

- End-on antenna
- Body shielding
- Reflector @ $\frac{1}{4}$ / $\frac{1}{2}$ λ

Attenuation

(Sig level diff often easier to spot at certain threshold) att. box, bad antenna collection

More Info

Lots of info on Internet. One site: <http://www.homingin.com/>

This document: <http://www.mmsherc.net/education/rdprimer>