Hidden Transmitter Hunting

Dale Hunt WB6BYU

Introduction

- What is Transmitter Hunting?
- Why would we want to do it?
  - ELT searches
  - Locating sources of interference
  - Locating balloon / rocket payloads
  - **Fun / recreation / sport**
- Why am I the one up here?

Transmitter Hunting Summary

- Transmitter hunting has practical uses, but mostly we do it for fun.
- Doesn’t require expensive equipment.
- Equipment often can be home-built.
- Transmitter hunting is a skill that requires practice.
- Receive only - no license required.

Radio Propagation Principles

- **Signals travel in a straight line until reflected or absorbed.**
  - Reflections and blockages make RDF more difficult, especially on VHF/UHF.
- **Signals get weaker the further they travel.**
  - Strength increases as you get closer.
- **Signals loose strength at a reflection.**
  - Put more trust in the strongest signals.

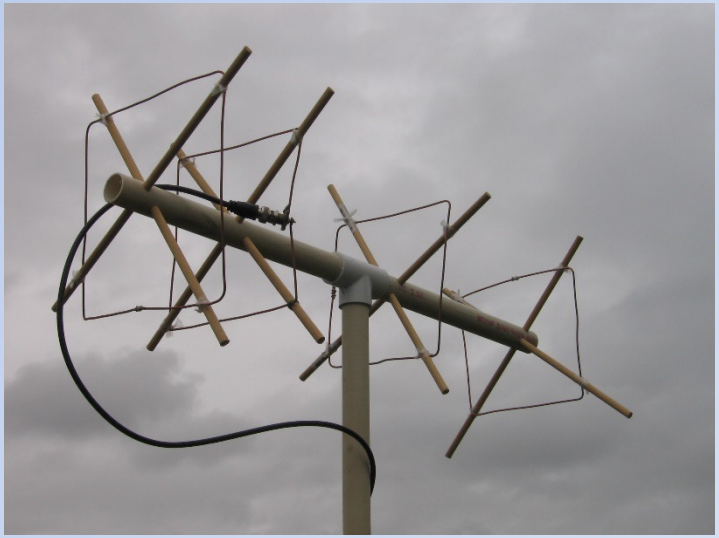
SEA PAC

Radio Propagation Principles

- **Signals travel in a straight line until reflected or absorbed.**
  - Reflections and blockages make RDF more difficult, especially on VHF/UHF.
- **Signals get weaker the further they travel.**
  - Strength increases as you get closer.
- **Signals loose strength at a reflection.**
  - Put more trust in the strongest signals.

Tools for Determining Direction

- Antenna with directional pattern



- Some way to measure signal strength

- Some way to reduce signal strength as you get close to avoid receiver overload
  - "Attenuator"

Types of directional antennas

- Yagi
  - Most standard designs will work
  - Taller than a quad for vertical polarization
- Quad
  - Less height for vertical polarization
  - More awkward
- Loop antennas typically used at HF
- Many other options for specific situations

2-Element Quad Antenna

Made from PVC pipe and copper wire.

3-Element Tape Measure Yagi

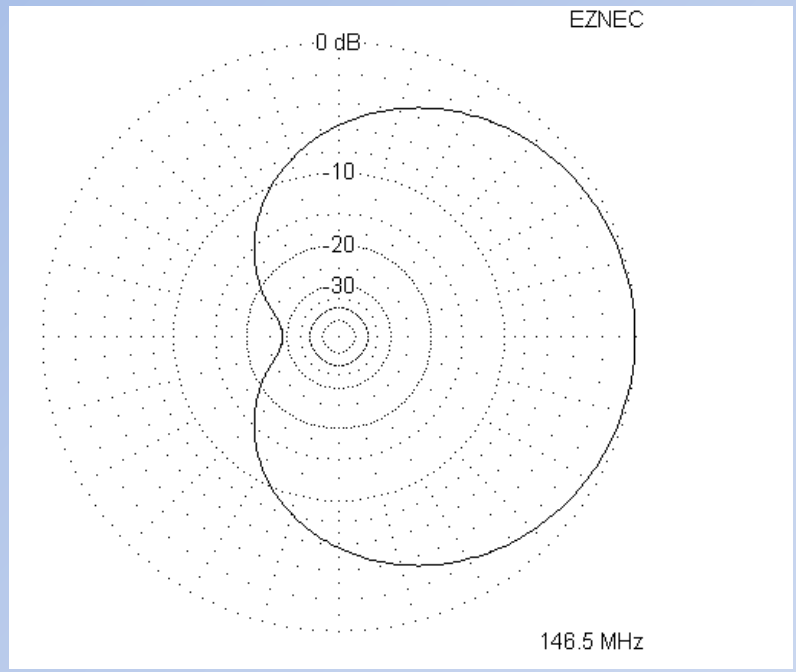
Flexible elements made from tape measure blades allow elements to bend.

6-Element Yagi for 450 MHz

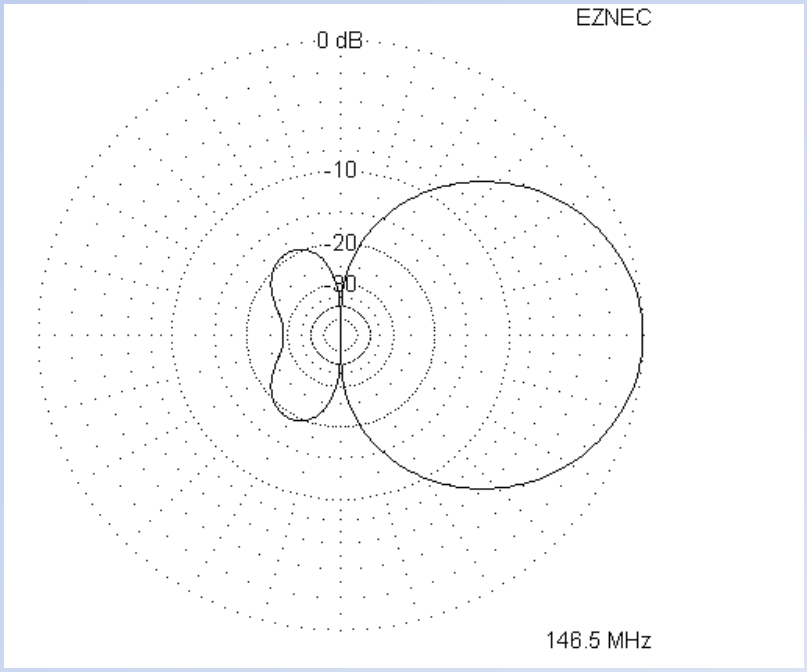
Made with wire and PVC pipe.

Directional Antennas

- Know the pattern of your antenna



Rotate for null (weakest signal)



Rotate for strongest signal

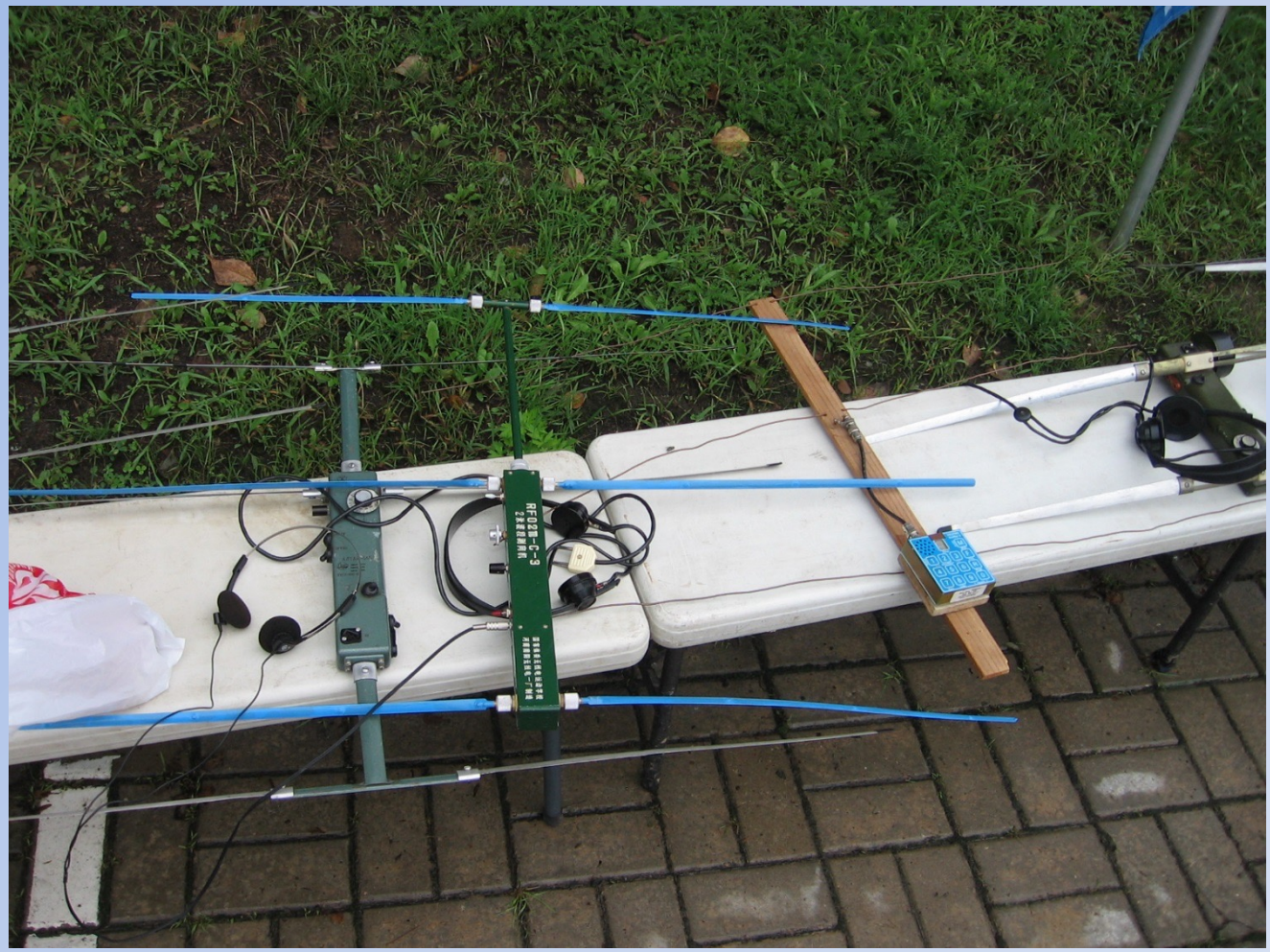
Receiver Choices

- Receiver/transceiver for frequency
  - Meter is useful, not required
  - Mobile rig in a car may be a simple choice
- Wideband receiver
  - SSB/CW best for very weak signals
  - Allows harmonic sniffing
- Specialized receivers
  - VK3YNG “Blue Box”

Attenuator

- Why do you need one?
  - When you get close the signal gets too strong, and pins meter in all directions
- Types
  - Waveguide beyond cutoff
  - Resistive attenuator
  - Offset / active attenuator
- May be built into sophisticated receivers.

SEA PAC

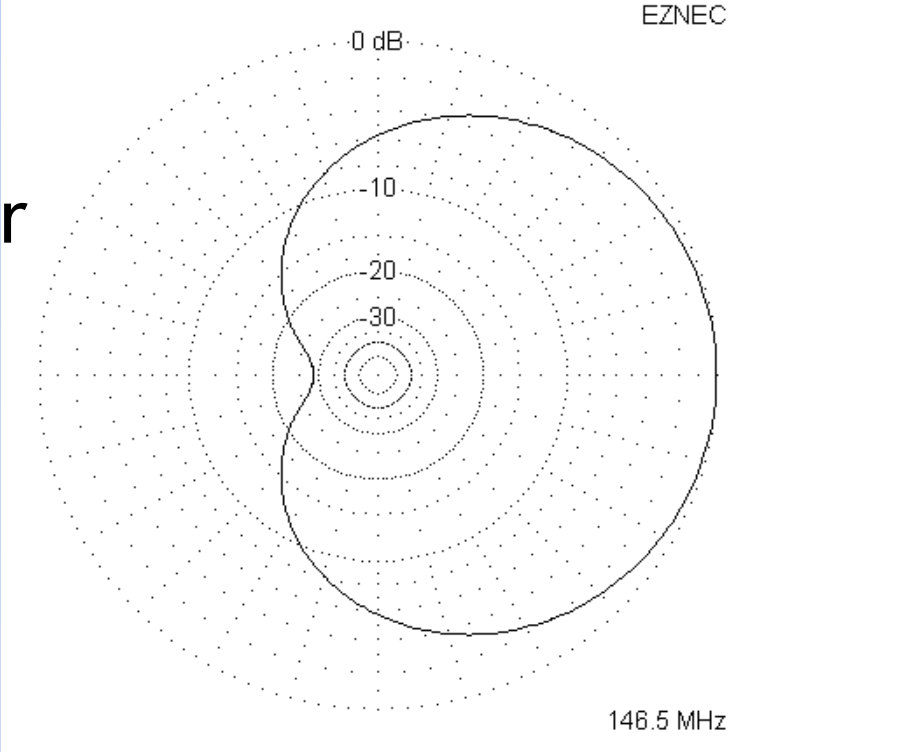


Receivers attached to, or built into, the antenna are convenient for hunting on foot. These receivers include a built-in attenuator.

14

EXAMPLE: "Body Shielding"

- Directional antenna:
  - Use your body as a reflector
  - Hold radio close to your chest.
  - Signal is weakest when your back is to the transmitter, so your body is shielding the radio.



Body Shielding (continued)

- Some way to measure signal strength
  - If receiver has no meter, listen to the background noise when the signal gets weak.
  - Background noise increases as signal gets weaker.
  - When signal is weak enough, squelch will close and the noise will disappear

Body Shielding (continued)

- Some way to reduce signal strength
  - "Waveguide Beyond Cutoff" attenuator
  - Cardboard tube coated with aluminum foil.
  - Add a string to clip onto the radio.

We Used Our Tools

- Antenna with directional pattern
- Some way to measure signal strength
- Some way to reduce signal strength as you get close to avoid receiver overload
  - –“Attenuator”
- This gave us a bearing to the transmitter.

SEA PAC

Following Clues

- Finding the transmitter is a process of following clues to the source of the signal. Important clues include:
  - Direction
  - Signal Strength
  - Rate of change in direction
  - Rate of change in signal strength
  - Terrain shadowing
  - Non-radio clues: keep your eyes open!

SEA PAC

Steps in a transmitter hunt

- Signal acquisition
- Triangulation
  - Plot bearings on map to get an estimate
- Homing
  - “follow your nose”
- Sniffing
  - Up close and personal

High points are best for hearing weak signals

Types of transmitter hunts

- Mobile
  - Mostly from a vehicle
  - Can be up to several hundred miles
- On foot
  - Fun for a club picnic
  - International competitions (ARDF)
- Fixed
  - Triangulation using multiple fixed stations

May require different types of equipment

SEA PAC

Mobile hunting

3-Element quad for 121.5 MHz mounted through sunroof.

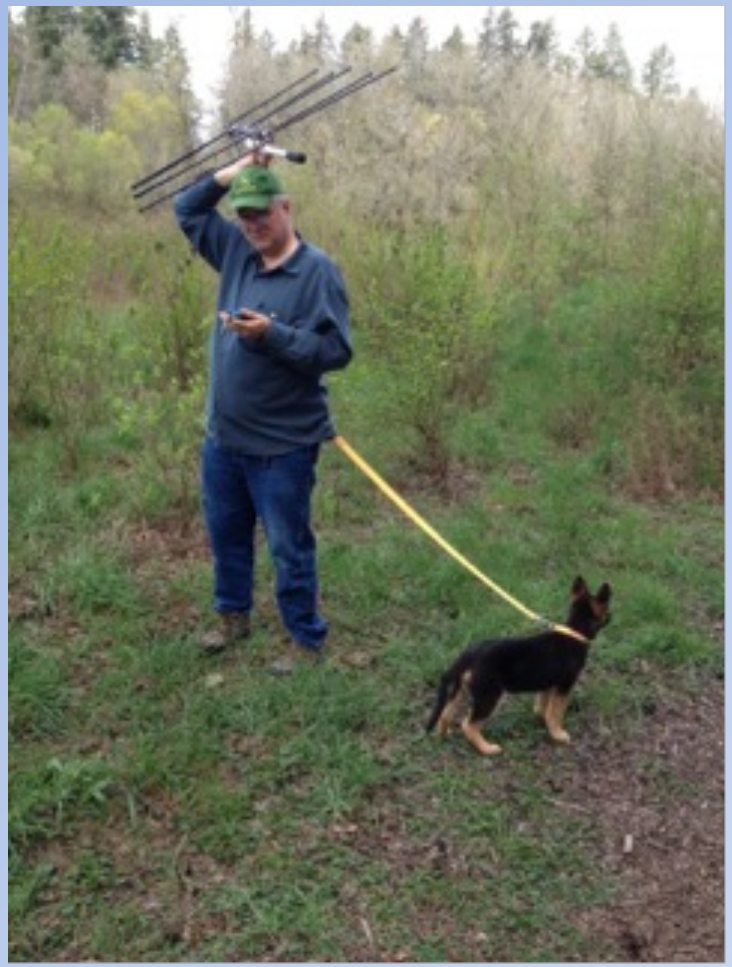
ARDF or “Radio Orienteering”

- Done on foot in a large park or forest using map, compass, and DF receiver.
- Course lengths may be 2 to 6 miles with up to 5 transmitters.
- Competitions held on 2m and 80m.
- US Championships held every year.
- Region and World Championships held every other year.
- Equipment optimized for use while running.

SEA PAC

Hunts can take place in a local park.

Fun For All Ages



Flag is visible from 10’ or more

Casual or Serious

A walk in the park or a run in the rain

The point is to have fun.

Summary

- Transmitter hunting is fun, can be useful.
- Doesn’t require expensive or elaborate equipment.
- Equipment often can be improvised or home built to meet a specific need.
- Transmitter hunting is a skill that requires practice, to learn how to interpret the clues.

SEA PAC

Hidden Transmitter Hunting

Dale Hunt WB6BYU

Contact:

Dale Hunt, WB6BYU
wb6byu@arrl.net

SEA PAC

Additional information

- Online resources
- Tips on taking bearings
- Sources of confusion
- Other types of equipment

SEA PAC

Transmitter Hunting Resources

Many facets of transmitter hunting, with lots more links:

- http://www.homingin.com/

Offset Attenuator plans:

- http://www.homingin.com/joek0ov/offatten.html

ARDF as a sport in North and South America (with links):

- http://www.ardf-r2.org/

Commercial DF equipment:

VK3YNG “Blue Box” receiver: http://www.foxhunt.com.au/

L-Tronics direction finders: http://www.ltronics.com/

Contact me with questions: wb6byu@arrl.net

SEA PAC

Tips for taking bearings

- **Height is good.** Even a freeway overpass can make a big improvement.
- **Find a clear spot**, without a lot of buildings or metal objects around.
- **Try multiple locations**. Just moving a few feet can often make a difference.
- **Go somewhere else** when bearings seem confusing or erratic.

SEA PAC

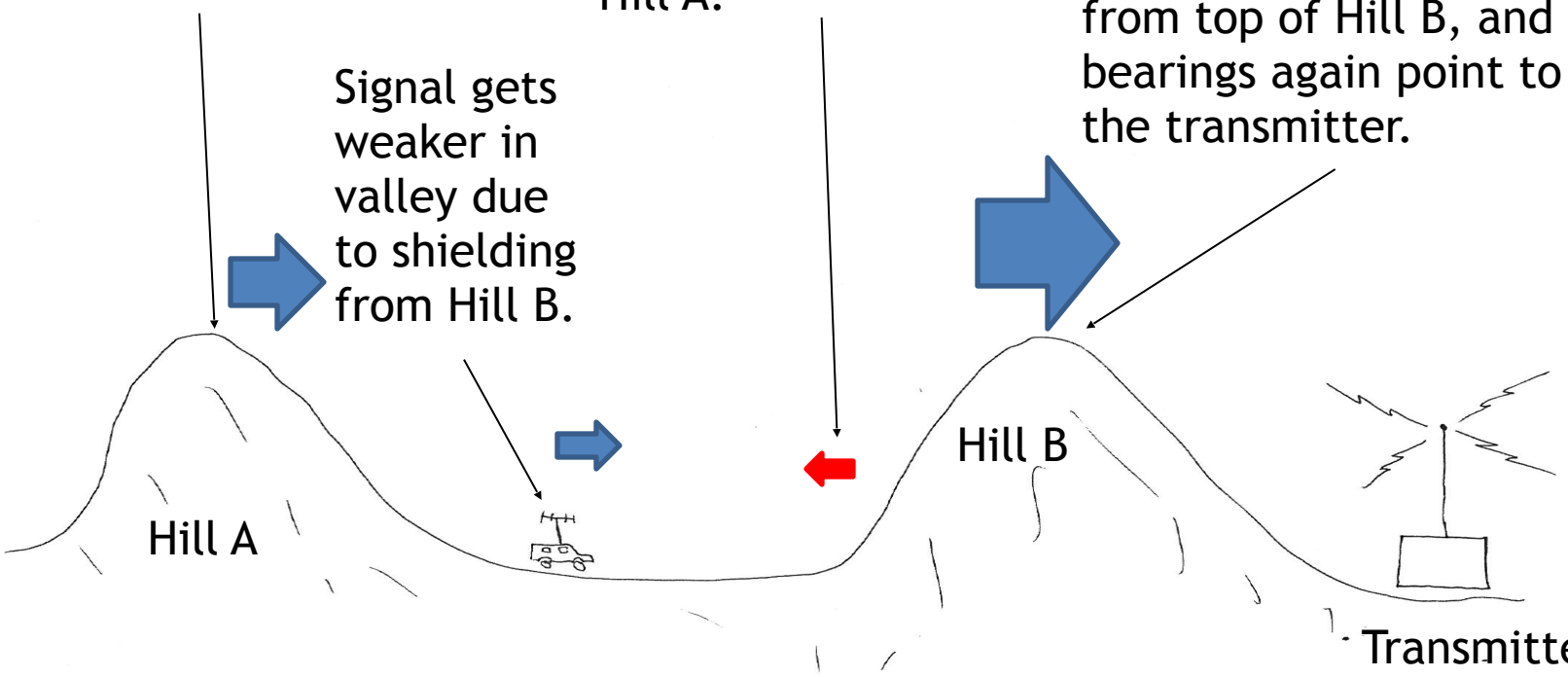
A Common Problem

From top of Hill A, bearing points to transmitter with good strength.

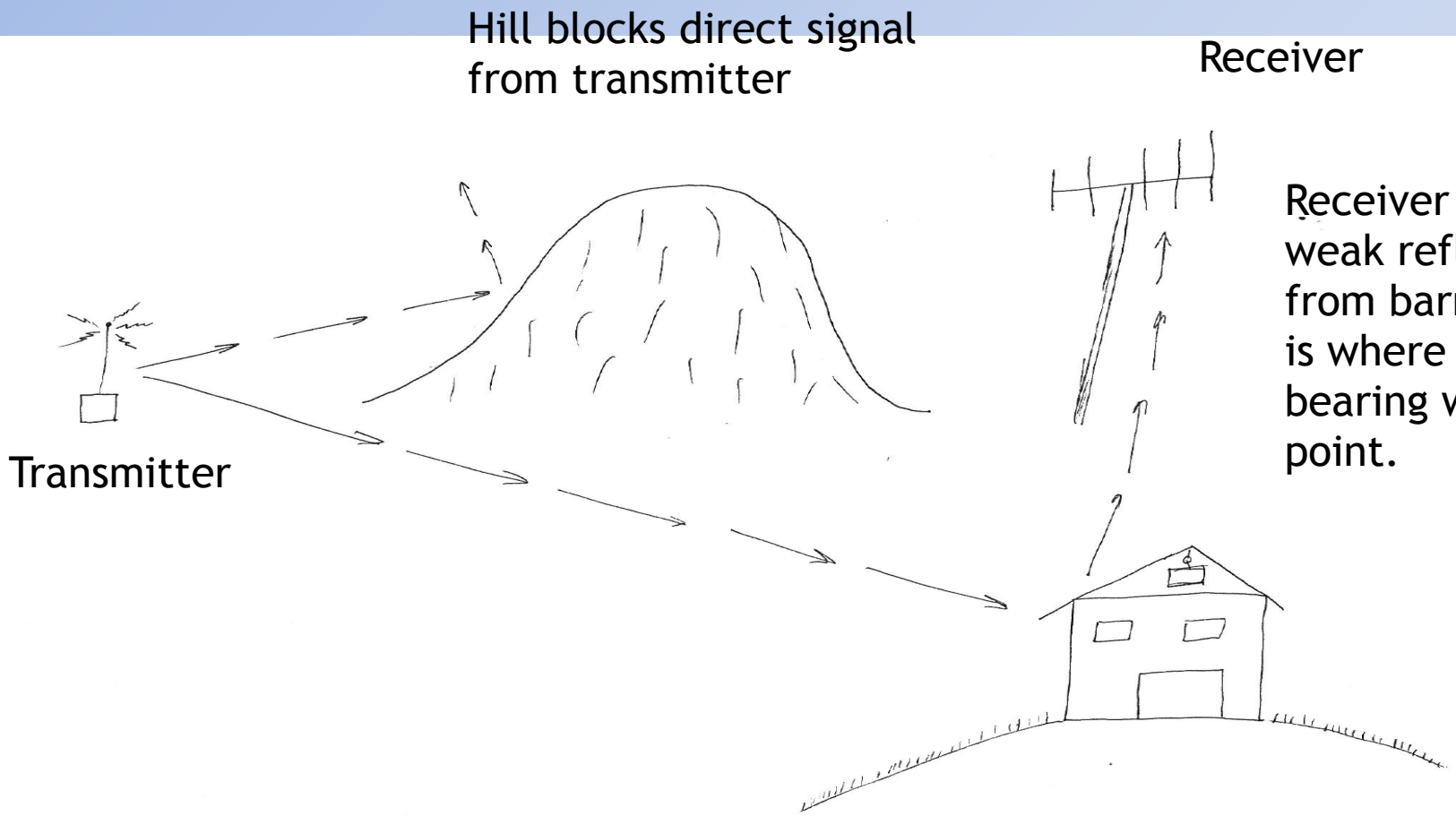
Signal gets weaker in valley due to shielding from Hill B.

Signal is blocked by Hill B. Bearings **reverse**, pointing to the reflection from Hill A.

Signal is much stronger from top of Hill B, and bearings again point to the transmitter.



Sources of Confusion



Other types of equipment

- Time Difference of Arrival (TDOA)
  - Uses a pair of antennas
  - Sometimes indicate LEFT/RIGHT
  - Convenient to use, confused by reflections
- Doppler
  - Array of 4 or 8 antennas in a circle
  - Ring of LEDs or digital readout
  - Good on fairly strong, vertically polarized signals
  - Gets confused by reflections