# The "Know It All" Guide to Basic Radio Direction Finding (RDF) Techniques

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Exclusively created for QSY Society

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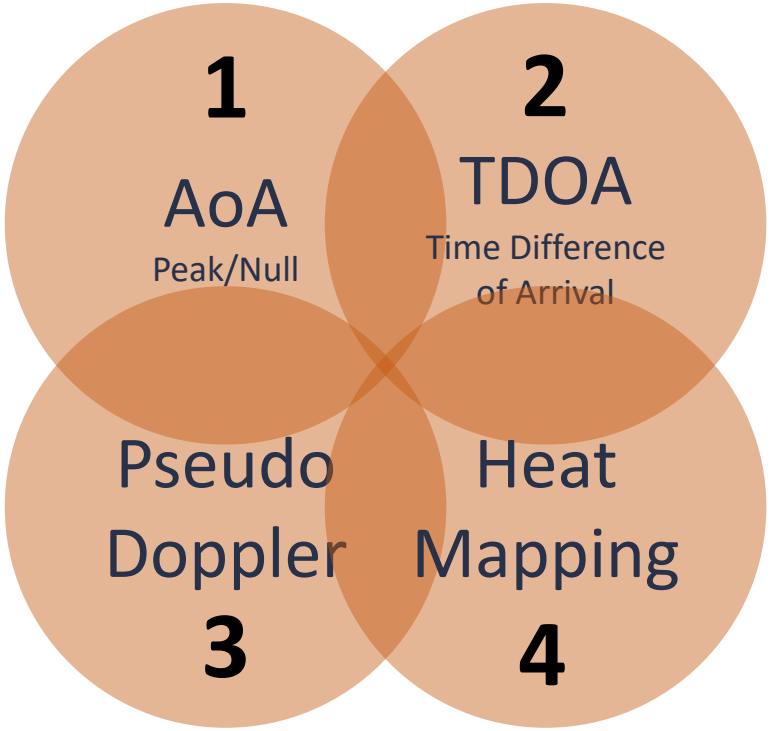
# Controlled Torture By Power Point

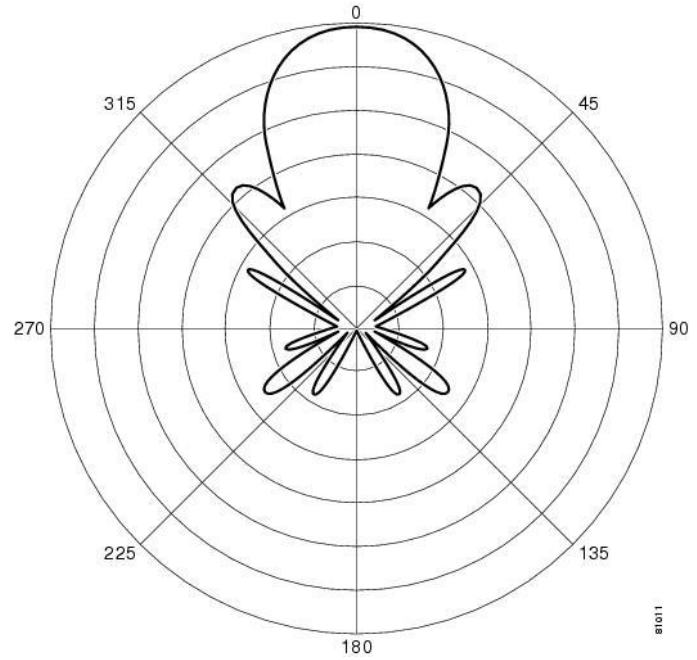
- ❑Top 4 Common Methods for RDF
- ❑What can you RDF?
- ❑Questions + Super Secret Tips & Tricks
- ❑Let's do an “RDF” hunt….right now!

# Top 4 Common Methods for RDF

- Some techniques overlap with others.
- There is not just one way to RDF.
- Different frequencies (or modes) function better/worse with certain techniques.
- RF field strength is important for all 4 methods.



# #1 - AoA = Angle of Arrival




- Directional antenna most common for AoA
- Tuning for maximum signal “peak” harder sometimes
- Tuning for minimum signal “null” easier sometimes
- You need to understand how your antenna works to see if better for peak or null based RDF
- Most common method for RDF and very portable.

# #2 - TDOA = Time Difference of Arrival

- Two antenna at known distance apart & in same polarization needed
- Difference of “nano” or “milli” seconds between signal arriving at each antenna.
- Electronics do the math. Compares signals between which was 1st, and which was 2nd to be received. Very portable though!
- Typical difference output as an audio tone easy to detect by human ear. Lights and meters also.
- Not 100% clear if backwards or front from fixed position

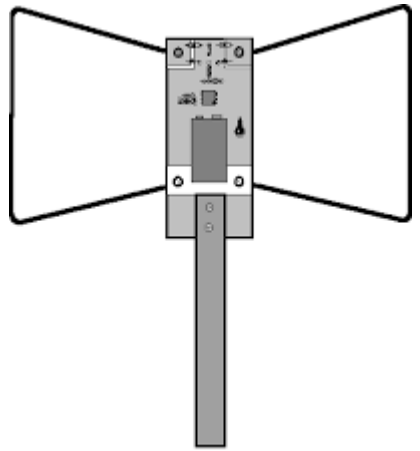
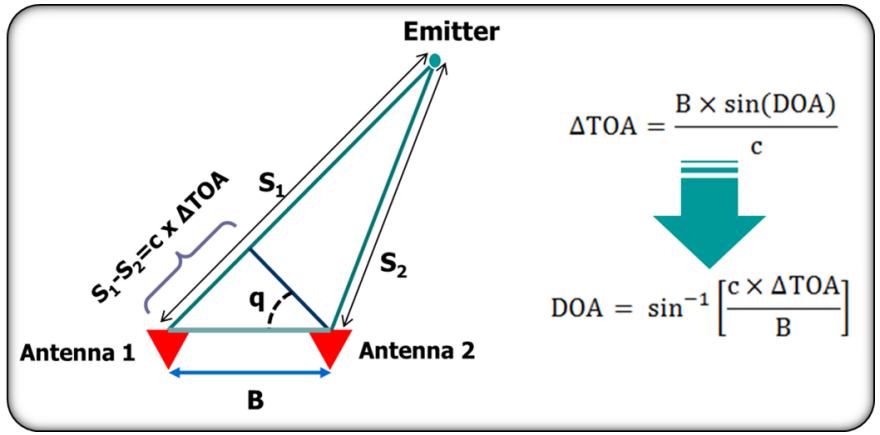
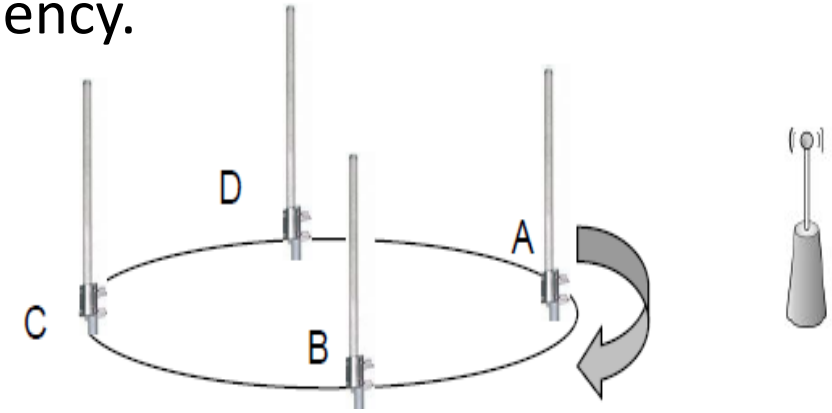


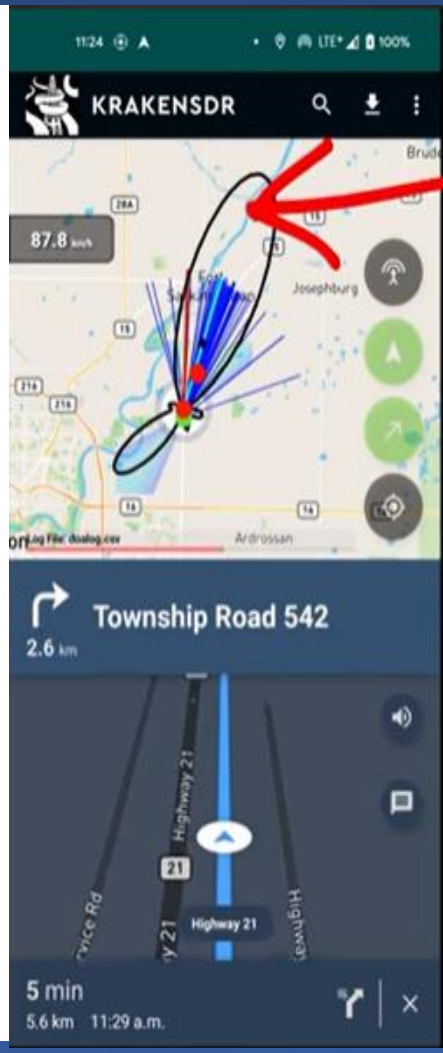
Fig. 1 - The assembled TDOA antenna unit - coaxial cable to receiver runs behind the PCB and through the PVC pipe handle.



# #3 - Pseudo Doppler

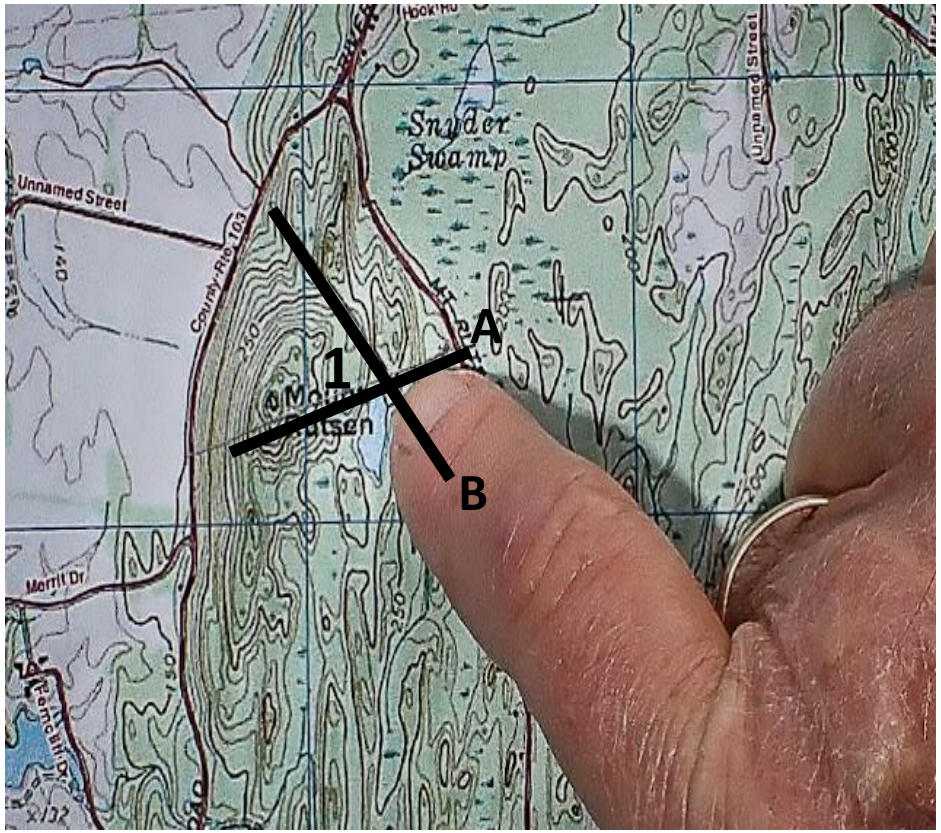
- Improves upon TDOA, but same basic theory.
- Common for 4 antenna needed, but 5 is better.
- Fast switching between 4 (or 5) antenna compares signals and gives more accurate direction.  Complex math.
- Systems more dependent on setup and frequency.
- One of best methods for fixed or mobile RDF.
- Not very portable.



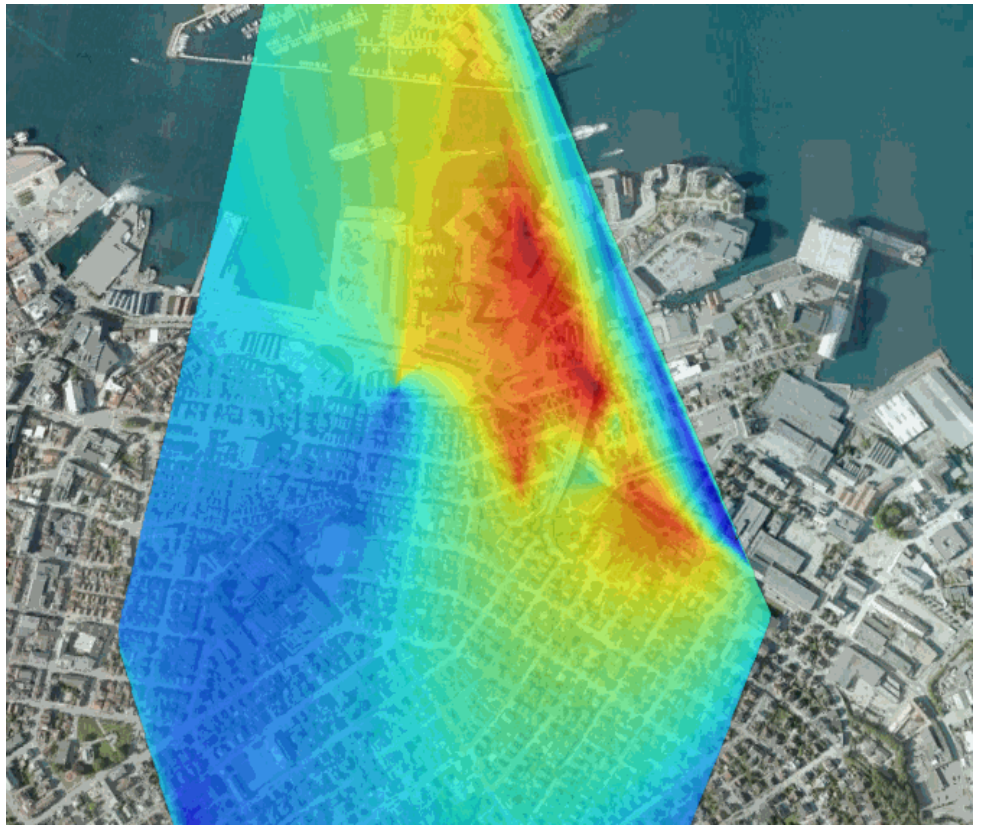
# #4 - Heat Mapping (Trilateration)

- Take signal measurements from multiple points & combine with GPS location.  Visualize the data.
- Trilateration (TriLat) is like heat mapping, but requires measurements from different AoA locations
  (See map A & B) tuned to signal peak.
  Intersecting bearings show location (1).
- Triangulation methods are slow but effective.
- Combining multiple locations with directional antenna really great for narrow heat mapping. Can be portable.



# #4 - Heat Mapping

- Take signal measurements from multiple points & combine with GPS location.  Visualize the data.
- Trilateration (TriLat) or Multilateration (MLAT)is like heat mapping, but requires measurements from different locations tuned to signal peak.
- One receiver can be used for heatmapping.
  Not best for fast signals. Can be portable.



- Can take a long time to build a map for accuracy if signal location or direction not changing.

# What can you RDF?

- Hidden amateur “radio sport” or “fox” transmitters.
- Endangered turtles (and other creatures)
- Interesting things in your neighborhood (be safe)
- Signals that interfere with your hobby
- (intentional or unintentional)



# Cheap gear to acquire (Not including HF)

- **Basic AM handheld radio or civil VHF Air - Why?**
  - Great for broadband noise and built in ferrite antenna. Good for RFI detection learned by RDF.

- **A real VHF & UHF radio with a S-meter (Not a cheap BaoF%&$) – Why?**
  - Cheap radios will overload near strong signals. A real S-Meter helps with null/peak.
  - Tuning to harmonics better with some radios over others. (Example: 146.565 x 3 = 439.695)

- **Directional VHF antenna & appropriate connections – Why?**
  - The antenna is important. Narrow beamwidth better than more gain.
  - Do not use RF adapters which promote signal “leak in”.

- **Cheap SDR & GPS USB dongles – Why?**
  - Computers and radio make everything better. See my hvdn.org blog for articles.
  - Great for finding IoT or consumer devices and advanced RDF cases.

- **Crazy Friends – Why?**
  - You need people brave enough to go look for hidden transmitters and practice RDF.

# Questions + Super Secret Tips & Tricks

(Available for those who attended in person. Ask Mark WA2NYY when is the next QSY meeting)