Antenna Traps

By request, I have been asked to give a short 10-15 minute discussion on Antenna traps (**Traps**). Time will be a limiting factor on how much we will be able to cover. Because we have lot to cover, **please hold the talking & questions until the end**.

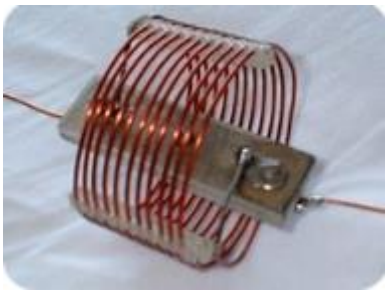
While traps can be used in other ways, today we will focus on their use to convert a single conductor into a "Multi-band" antenna. However, traps have high loss and should be avoided whenever possible. The first loss is a result of high "**I^2 R**" losses; and the second is due to antenna length. Let's unpack this today.

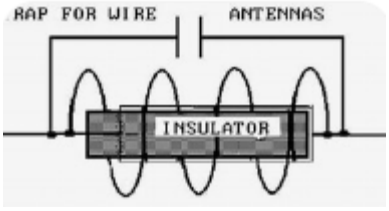
You will know how, what, when & why:

- What is a trap?
- How is a trap used?
- DYI How to make a trap? (*Trap calculator*)
- When and where you should use a trap?
- Why you should avoid using traps?
- What are the alternatives to traps?
- Why you can spend hours or days trimming for low SWR and still not work the most wanted DX?

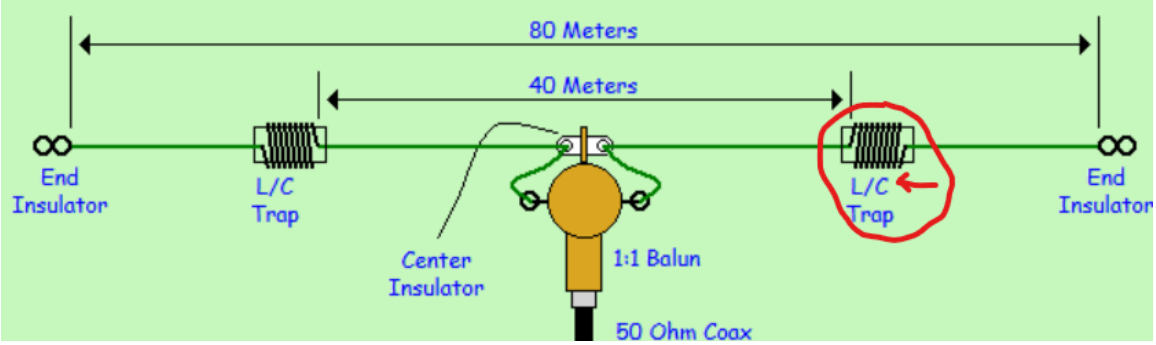
Remember – Golfers and top DXers try to avoid traps!

What is a trap & what does it do? First, basically a trap is simply a parallel L/C (*inductor and capacitor*) circuit. Parallel circuits block a specific frequency while passing all other frequencies. Remember that the coil does very little radiating even though the same amount of power (*not current or voltage*) passes through the coil as does the radiating part of the antenna. Below are pictures of typical traps.





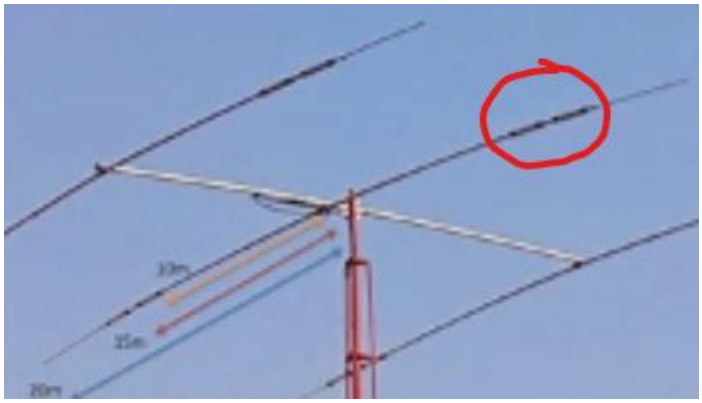
How are traps used? For the most part, traps are used to convert a single wire or element into a multi-band antenna. Many bands are possible. Traps can be used in dipole antennas, vertical antennas, yagis (beams) and more. First, let's look at a simple two (2) band dipole.



This antenna can become a three-band antenna with only one trap by cutting the 40 meter antenna no higher than 7.100 MHz. Pending your surroundings and height over ground it will work on 15 meters as well. It can be used on other types of antennas as well.

When and where you can use a trap? Traps are used not only on dipoles, but also on yagi antennas, vertical antennas, cubical quad antennas and more. Below are pictures of a few uses.

NOTE: The 3-band yagi has 4 traps on all three elements for a total of 12 traps. The worst part is that 4 traps are on the driven element, and as we all know the driven element handles 100% of our transmitted power. We can do better by a factor of 20 to 50 times.



How to make a trap - Here's a useful calculator:
https://www.wireantennas.co.uk/hf-trap-calculator

Why you should avoid using traps: (*Two types of losses*)

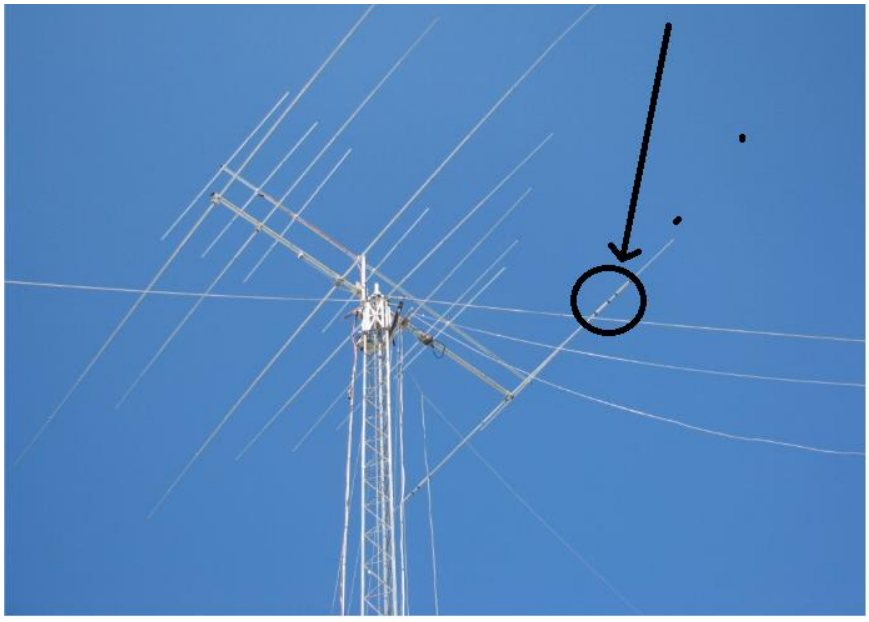
- "**I^2 R**" losses
- Losses due to antenna length

I^2 R converts your TX power into **heat** thus does not get radiated. The station owner gets fooled by his SWR meter. The reason is, even though this is pure loss, surprisingly the loss reduces your SWR meter reading as this power does not get reflected to your meter. Unfortunately the station owner is left thinking his antenna is performing at top efficiency because of the low SWR. In reality, more of your antenna is acting like a dummy load.

Antenna length loss is of major importance. Do not underestimate this factor. Every time you double your antenna length, you improve your "radiation resistance" by the square. Radiation resistance is the major ingredient for antenna efficiency. Doubling your antenna length improves it by a factor of 4. Tripling improves by a factor of 9, etc.

SWR is NOT a measurement of antenna efficiency. A dummy load has perfect low SWR, yet it has zero antenna efficiency. This is because the SWR meter can NOT measure antenna efficiency. An SWR meter can **not** guide you to an improved and efficient antenna design. Always strive to improve radiation resistance to improve your antenna efficiency. Always keep the radiating part of your antenna as long as possible.

A limited & high efficiency use of a trap: Note →Antenna below has only one trap element and that is in the reflector. Less than **2**% of transmitted power is present in the reflector element, thus very little power can be lost. The theory on this antenna is a topic by its self and can be discussed at a later time.



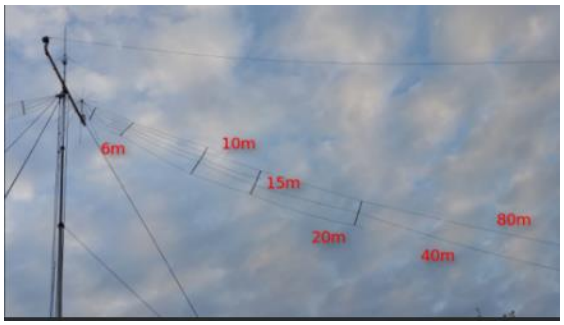
========== End of Part 1: Antenna Traps ==========

========= Part 2: More About Antennas and Traps =========

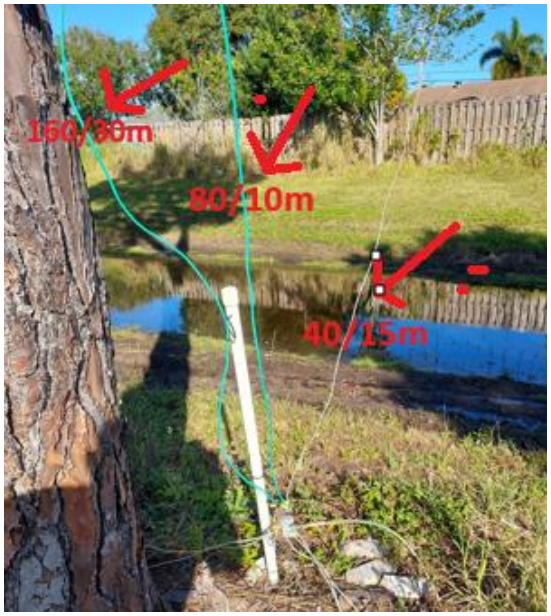
What are the alternatives to traps? Remember – Golfers and top DXers try to avoid traps!

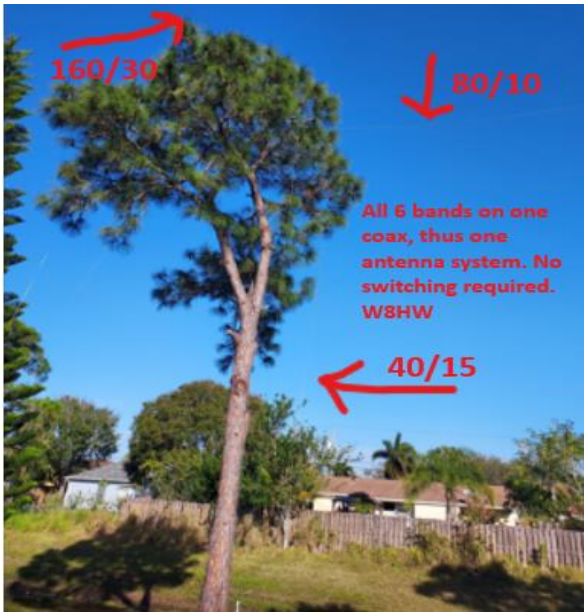
There are many ways to multi-band your antenna with no traps → Fan dipoles – Large loops – Vertical – Yagi, Carolina Windom, Doublets and more. See examples below.

Below is a home brew FAN dipole. No traps. Great stateside coverage (*high angle of radiation.*)

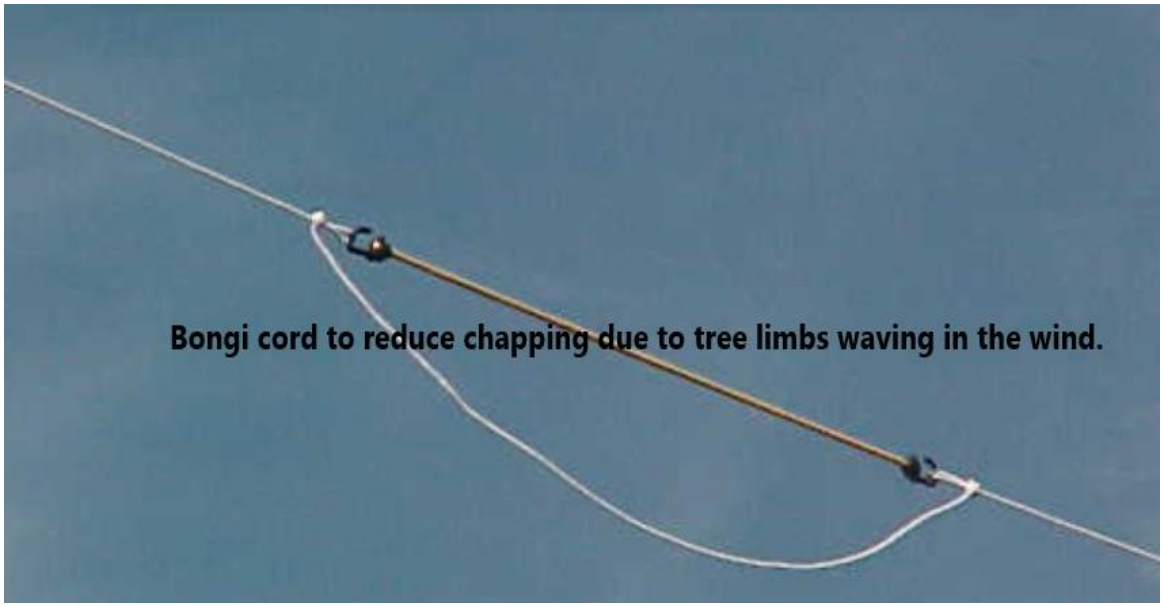


Below is homebrew tree antenna (*sort of*). 6 band antenna, no traps → Low angle of radiation, thus great DX. Here are 4 pictures of the antenna from different angles.





Inverted L antenna - Giving low angle of radiation. Outstanding DX on 160-80-30-40-15-10 m



Below is a large loop antenna (430 foot): It was fed using home brew 600 ohm twin lead into a tuner. It was one of the most efficient antennas I have used, and it had a 12 to 1 SWR. Tuners return reflected power to the antenna and the 600 ohm feed line reduces line loss to less than RG-8 at 1-1 SWR (*see chart below*). Used mostly on 80-40-30 meters, every net reported it as the strongest signal on the net. See loss calculator links: http://kv5r.com/ham-radio/coax-loss-calculator/, or https://www.qsl.net/co8tw/Coax_Calculator.htm

Myth → Tuners only fool transmitters. Tuners have 4 jobs. One is to return reflected power to the antenna. Do you know the other 3?

I no longer have this antenna. The lot to our east had trees removed and home built.

Feedline Comparison

100 foot at 10 MHz

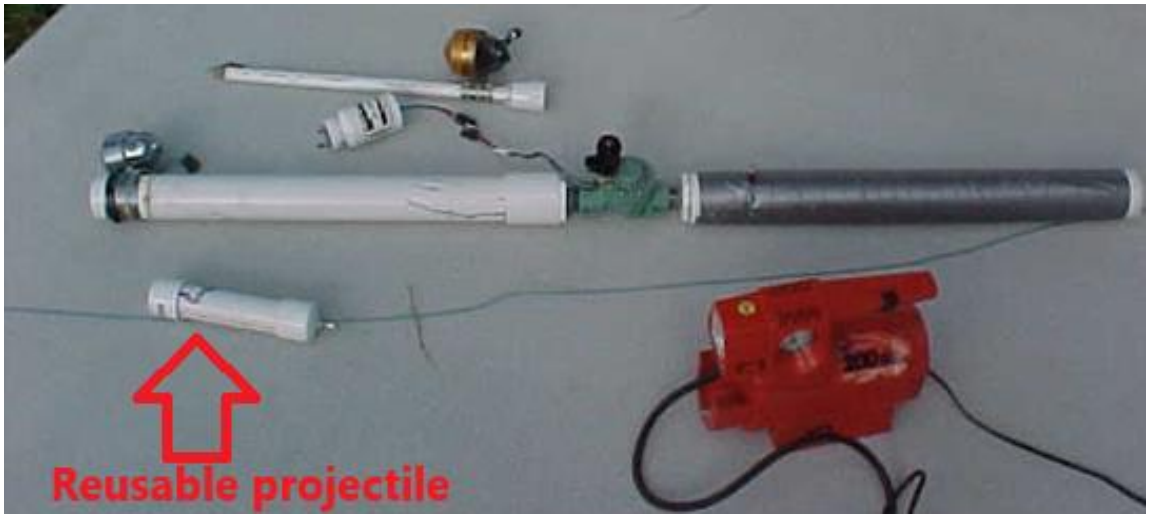
SWR	1-1	3-1	5-1	10-1	20-1
RG-8	87%	82%	75%	60%	44%
600 ohm	98.6%	97%	96%	93%	88%

100 foot at 28 MHz

SWR	1-1	3-1	5-1	10-1	20-1
RG-8	80%	72%	63%	47%	31%
600 ohm	97.6%	96%	94%	89%	87%

Question: How do you get a wire antenna to the top of tall trees?

Answer: With a homebrew antenna gun!



Main difference between a Windom and a Doublet antenna - The Windom is OCF (off-center fed 14%) while the doublet is center fed.

Info on Non-Resonant Antennas: https://youtu.be/Ce5zsM_O6jk

Length of wire antennas is critical. Listed below are <u>good</u> and <u>best</u> lengths for your non-resonant antenna. (Note: length is indicated in feet.)

<u>Good:</u> 16 19 22 26 32 33 38 43 46 48 52 64 65 66 76 78 80 88 92 95 96 99 104 110 112 114 123 128 130 132 133 138 144 152 154 156 160 165 171 176 182 184 190 192 195 198 208 209 220 224 228 230 231 234 240 242 246 247 256 260 264 266 272 276 285 286 288 297 304 308 312 320 322 323 325 330 336 338 342 352 361 363 364 366 368 369 374 380 384 390 396 399 400 414 416 418 429 432 437 440 442 448 455 456 460 462 464 468 475 480 484 494 495 496

<u>Best:</u> 29 35.5 43 58 71 84 107 119 148 203 347 407 423

If you antenna doesn't match one of the lengths shown above, trim it for improved performance.

<u>Attention</u>: I can design & build <u>for you</u> automated or smart devices**, using microcontrollers and other.** Many of my devices have been used around the world. I am a retired Broadcast and radio systems engineer who loves to design, test and build. I do complete software & hardware design. If you have a <u>need</u> or <u>idea</u>, feel free to contact me. I can do it for less costs than you think, because this is a now a hobby for me and no longer a business.

Really→ Let's talk or email about your idea. It never hurts to talk. The results may surprise you. **If you have a need or idea, feel free to contact me via email today.**

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