TWO METER HOMEMADE SLIM JIM ANTENNA

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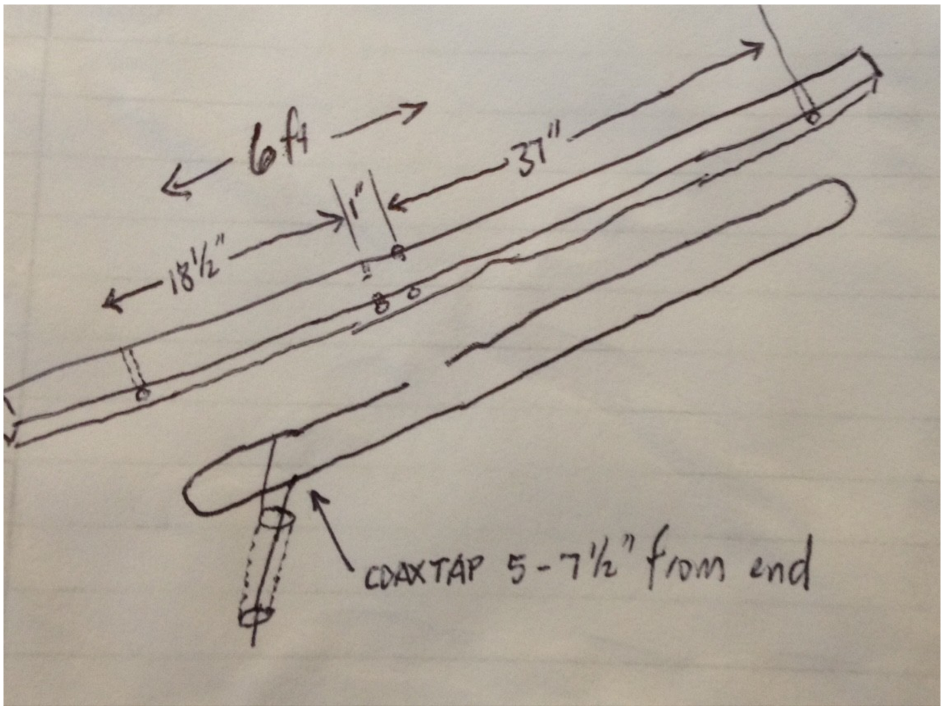
WIRE: Start with a piece of solid #14 AWG household wire approximately 3 yards and 9 inches long (117") (It is easier to be a couple inches too long and later nip the excess off.) Strip the insulation off of 36" at one end.. It is easiest to do this with a pocketknife while holding the wire against a solid flat surface.



Drawing of the wood and wire that make up the antenna. The end-fed folded dipole is the longer, righthand portion, while the transmission line matching network is the left hand portion of the wire to which the coax is attached.

WOOD: Start with a pressure treated 1x2 that is 8 feet long. These are typically less than $2 at home improvement stores. Leave several inches of space (perhaps 8") at one end to "hang" the antenna by, and drill a 1/4" inch hole through from front to back for later hanging. At 8" from the end (the "top" of the antenna) drill a 1/8" hole clear through from side to side. 37" from that first hole, drill a 1/8" hole just half an inch in to give you a stopping point for the folded dipole. Another 19.5" further down the wood, drill another 1/8" hole clear through for the shorting leg of the matching transmission line. The total length between the two through-and-through holes will then be 18.5" (matching section) + 1" (gap) + 37" (folded end fed dipole) = 56.5 inches, just a bit under under 6 feet).

Distances just aren't that critical. That 37" inch length is simply not critical. I tested 3" longer and 3" shorter and they still would work with just different coaxial cable attachment points, very little difference "shorter" and so with mewhat more difference with "longer". The matching transmission line distance probably isn't terribly critical, either.

CONSTRUCTION: Thread the wire through as needed to form the antenna as shown in the drawing, and secure it with electrical tape. Try to pull sections reasonably tight so the wire hugs the sides of the 1x2 wood. ***Cut off any excess as needed*** so that there is roughly a 1" gap between the free end of the matching line and the far end of the folded dipole end.

MATCHING: Using an antenna analyzer (with a very short connection, like 2-3" of wire) or an SWR meter (if possible, with a short connection, or a connection that is ½ wavelength (roughly 31" for RG8X) so the impedance isn't altered by your coax line), run the connection up and down the matching section. Use a finger on each side to make the connection, and keep them even with each other. You'll quickly find the point where you get an SWR very near to 1:1, often about 7" from the shorted end. Mark this, and solder the coax to it there, with the center conductor of the coax going to the longer side and the shield going to the side of the matching transformer that goes nowhere.

WATERPROOF: Use a liquid or grease sealant of your choice on the ends of the coax, run the coas either directly away from the matching loop or tape it right down the center. Secure the antenna wires and matching section every 12 inches or so with electrical tape.

FEEDLINE REFERENCE INFORMATION

Note that losses increase dramatically if the line has an SWR significantly greater than 1:1, and for ladder line, if the line is wet or covered with snow or ice.

Type of Transmission Line	100 foot loss in dB at 146MHz
RG58A/U (50 ohms)	6.1 dB
RG8X (50 ohms)	4.5 dB
RG 8 /LMR 400 (50 ohms)	1.5-2 dB
450 Ohm ladder line	0.4 dB

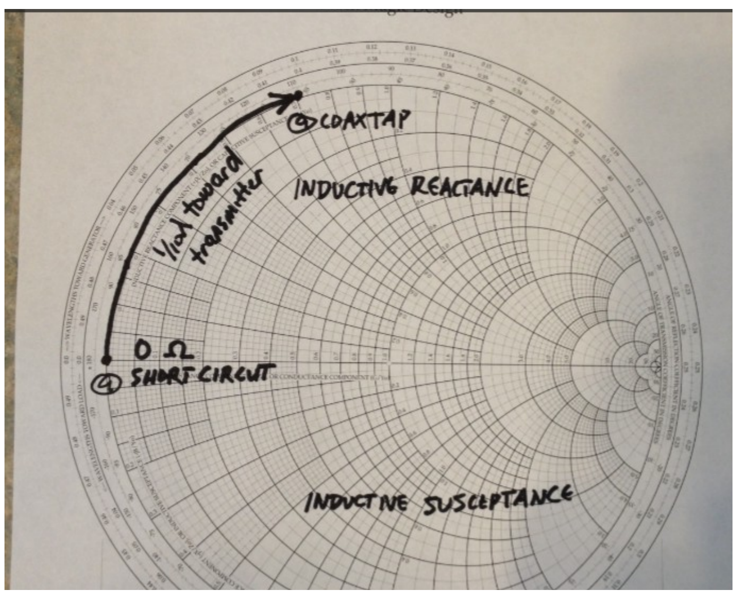
Remember! *These loss values are when the transmission line is operated with a perfect match-- 1:1 SWR. When the SWR is higher, there are points with much higher voltages and much higher currents, resulting in significantly greater losses, particularly for COAX lines. Open wire feeders do much better with high SWR's, but are much more susceptible to losses due to rain, snow, or ice.*

HOW IT ACTUALLY WORKS

The ***Slim Jim*** is a close brother to the ***J Pole***. Both use a transmission line matching system. The only difference between the two is the Slim Jim bends the antenna back on itself to make a "folded dipole" half wave end fed, while the J Pole simply has a single wire end fed dipole. There is only a very small difference in their performance, not worth worrying about. And a center-fed dipole also has very similar performance! You could cut off the folded-back portion of a Slim Jim, re-tune as needed, and use it as J Pole. **A quarter-wave dipole needs a fantastic radial system or an incredible ground system to equal the performance of a half-wave dipole, slim J, or J pole**

The matching section is much more fascinating. Although often represented as a ¼ wavelength "transformer" moving geometrically from 0 ohms at the shorted end to near-infinity at the open end, it is actually a more mundane – and complicated.

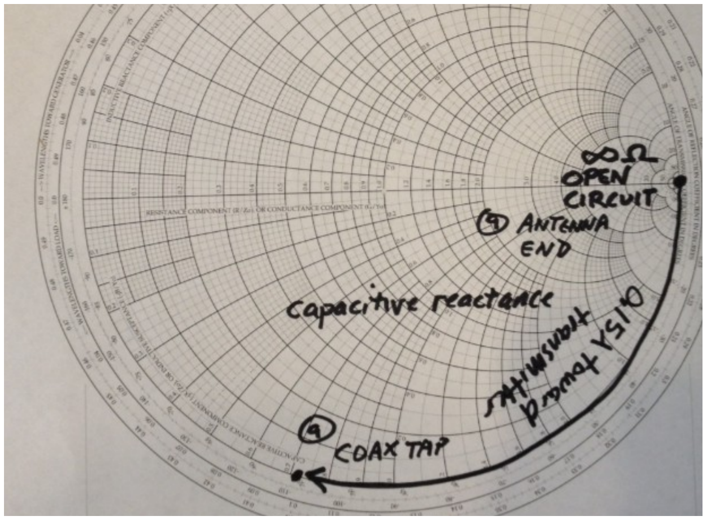
The shorted end stub is actually acting like an **inductor** in parallel with the coaxial feed, part of an L-network (inductor-capacitor matching network). How the shorted section acts like an inductor is shown on the Smith Chart below.



Shorted section has 0 ohms at its shorted end, but 1/10 wavelength away it has considerable inductance, which is in parallel with the coaxial feed.

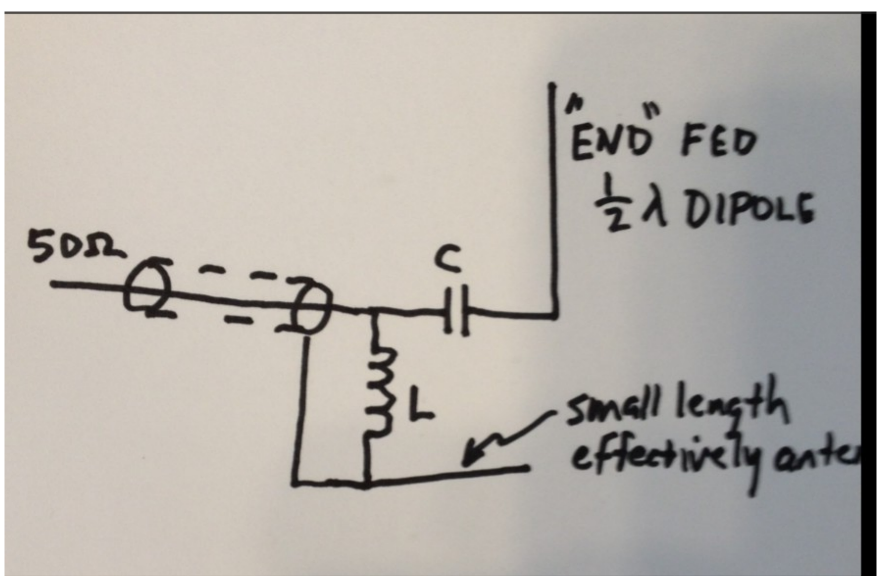
The apparently "open-ended" transmission line segment connecting the coax to the end-fed dipole probably plays two roles. EZNEC evaluation by others has shown that the currents in the two wires of the balanced line aren't exactly the same, and not exactly out of phase, either! So there is probably some antenna radiation from this "transmission line". In effect, it is providing a bit of antenna for the "other wire" of the antenna, making it not quite completely end-fed, but instead fed just INSIDE the end of the antenna (providing a lower impedance feed point).

The balanced feedline then performs matching duties by providing a series capacitance between the coax and the “near-end-fed” dipole.   How the (almost) open-ended section acts like a capacitor is shown on the Smith Chart below.



Seemingly “open-ended” balanced line section has near infinite ohms (near open circuit, because the end impedance of a ½ wave dipole is very very high, and the second wire of the feedline goes NOWHERE) but 0.15 wavelengths back toward the transmitter (at the coax feed point) it has significant capacitance – which is effectively “in-line” (in series) with the antenna.

The end result is that by picking the tap point with your coax, you are actually tuning the following L network that matches your coax to the antenna feedpoint impedance for best power transfer.



WRAP IT ALL UP

Things you learned from this antenna:

1. Most half-wavelength antennas have similar performance.
2. Center-fed dipoles have a modest feedline impedance (50-75 ohms)
3. End-fed dipoles have a very high feedline impedance and will need some sort of matching system to connect to coaxial cable
4. Coaxial cable has much higher losses, innately and with mismatched loads, than does open-wire or balanced line (primarily due to the losses in the dielectric. The more AIR in a transmission line, the lower the losses.
5. Open wire line is susceptible to increased losses if covered by rain, ice or snow.
6. On a smith chart, a dead short is at 9 o'clock.
7. On a smith chart, an open circuit (infinite ohms) is at 3 o'clock.
8. On a smith chart, when we want to move along a transmission line from the "load" toward the "generator" we go CLOCKWISE.
9. Smith Charts can tell us how the impedance varies along a transmission line.
10. While the impedance varies along the transmission line – and so do the steady state RMS voltages and currents – if the line were lossless, the SWR would remain the same.
11. The SWR is a simple way to express the ratio of the highest voltage to the lowest voltage along the line, or the highest current to the lowest current along a line.
12. SWR can be measured using a reflectometer, which is typically operated by "setting" the "forward" at the top of the scale, and switching to read the "reflected" which is also calibrated in SWR units.
13. SWR can also be measured using an antenna analyzer
14. A rough formula for the length of a half-wave wire antenna in feet, is 468/f where f is in MegaHertz.

VHF/ UHF SWR meter: The Workman 104 is the cheapest, but right now Ebay is the only place I can find it. You can use a normal CB swr meter if you literally swap it end for end after setting the forward, instead of using the "reverse" switch.

18 feet of cheap coax with PL259's: google TRUCKSPEC 18' coax PL259 and you'll find it

Another supply for coax patch cords is: UNIVERSAL RADIO http://universal-radio.com/catalog/cable/cable.html