



BACK-TO-BASICS SERIES

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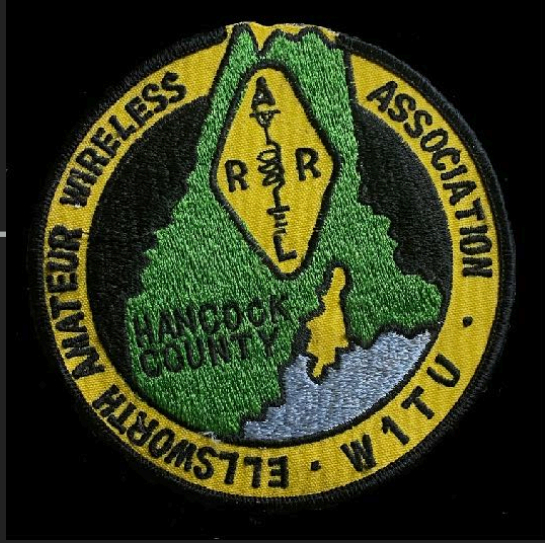
# BEGINNER STATIONS





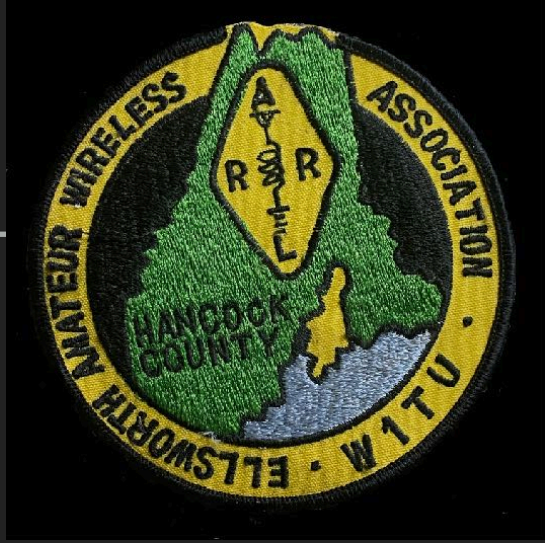
## AGENDA

- ▶ Stations & antennas for VHF/UHF
  - ▶ HTs and Mobile rigs for base stations
  - ▶ Coat Hangar ground plane 2-m antenna
  - ▶ Inexpensive Dual Band vertical
  - ▶ Coax
- ▶ Beginner HF Shack, Antennas
  - ▶ 10M & All Band, All Mode Rig
  - ▶ Simple but effective dipole
  - ▶ Multiband fan dipole
  - ▶ Amazing Sidebander Maypole
  - ▶ Coax, Baluns, Weatherproofing



## ALWAYS REMEMBER!

- ▶ The best bang for the buck – and most efficient way to optimize your ham radio station for great signals is by improving or changing type of your antenna and transmission line!!!!



## VHF/UHF STATIONS

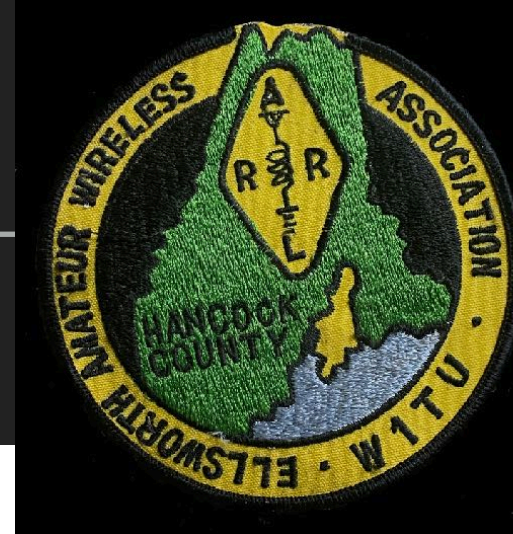
- ▶ Use handheld radios with adapters for external antennas
- ▶ HT & external antenna may cost about \$120.



**50-foot run of new RG-8U coax with PL-259 on each end costs about \$100**

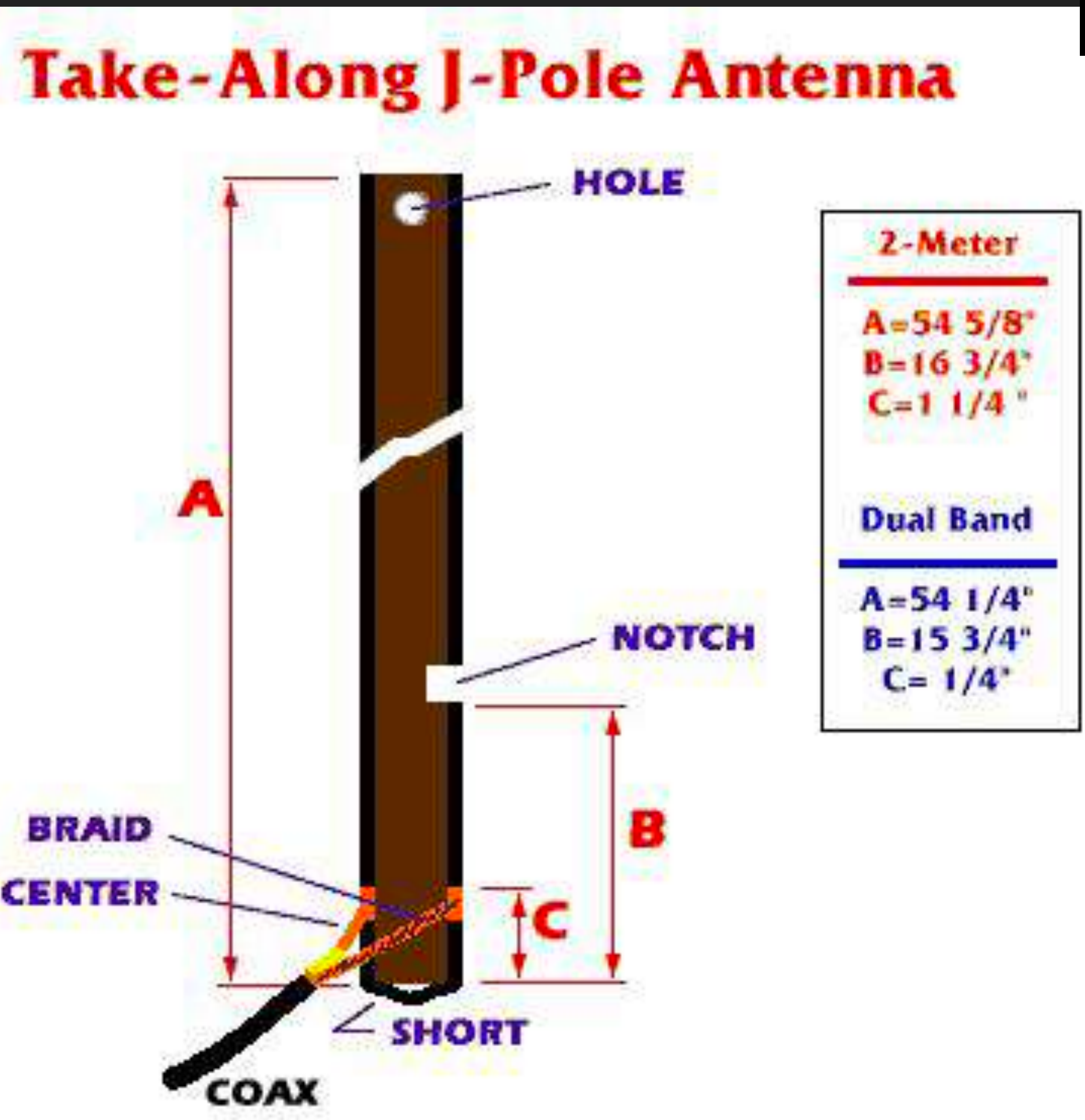
If using HT with stock antenna, keep it vertical! Must be vertical polarization!



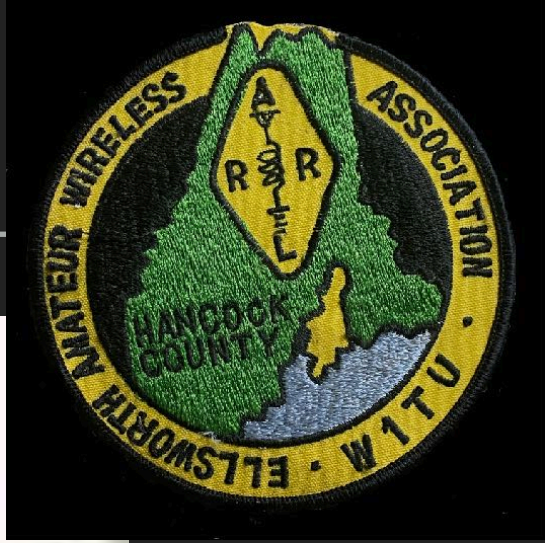


## VHF

- ▶ Twin Lead Jpole Antenna <https://www.qsl.net/wb3gck/jpole.htm>
- ▶ Put inside a section of PVC and install as high as possible on a tv mast.
- ▶ If using RG-8x, use short a run as possible.







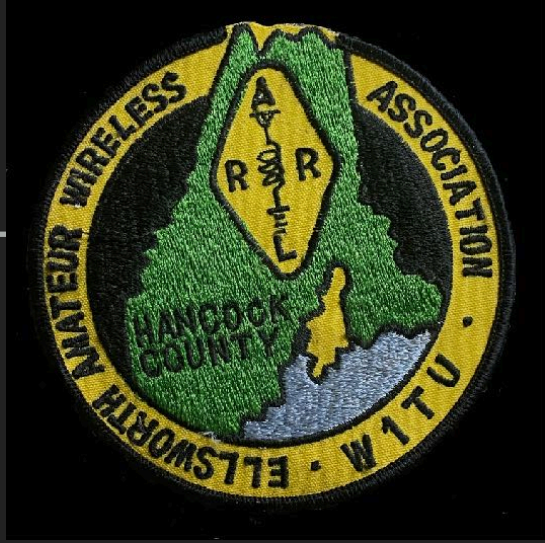
## VHF/UHF STATIONS

- ▶ Use an external mobile antenna with an HT in your vehicle. Use adapter to hook it to a mag-mount or other type of mobile antenna.



This could be you!!!!!!!!!!



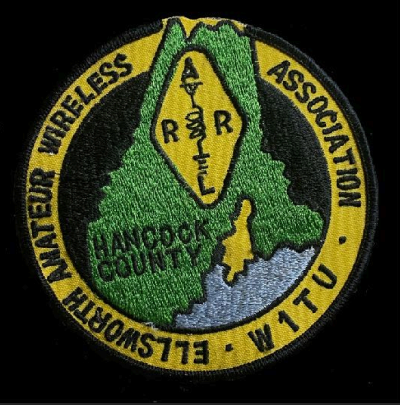


## VHF/UHF IN THE SHACK

- ▶ Use a mobile rig for your VHF/UHF base station. It is less expensive than a real high-end base station.
- ▶ Single-band 2-meter mobiles (new) are available starting at about \$100, although you might find some on Amazon for cheaper.
- ▶ Dual Band rigs such as a 2M/70CM rigs can be quite expensive although there are some models on Amazon for around \$150. Most quality ones start at \$300.
- ▶ Power supply should be able to handle the power/current draw from your rig.

You can make contacts through amateur radio satellites using dual-band transceivers 2M/70cm





## POWER SUPPLY FOR BASE STATIONS

- ▶ Linear power supplies are probably best, be wary of noisy switching supplies. However, the Alinco DM-330MV is excellent and does not appear to generate RF noise.
- ▶ Deep Cycle batteries are better than car batteries for power source. They better handle greater drains and recharges.



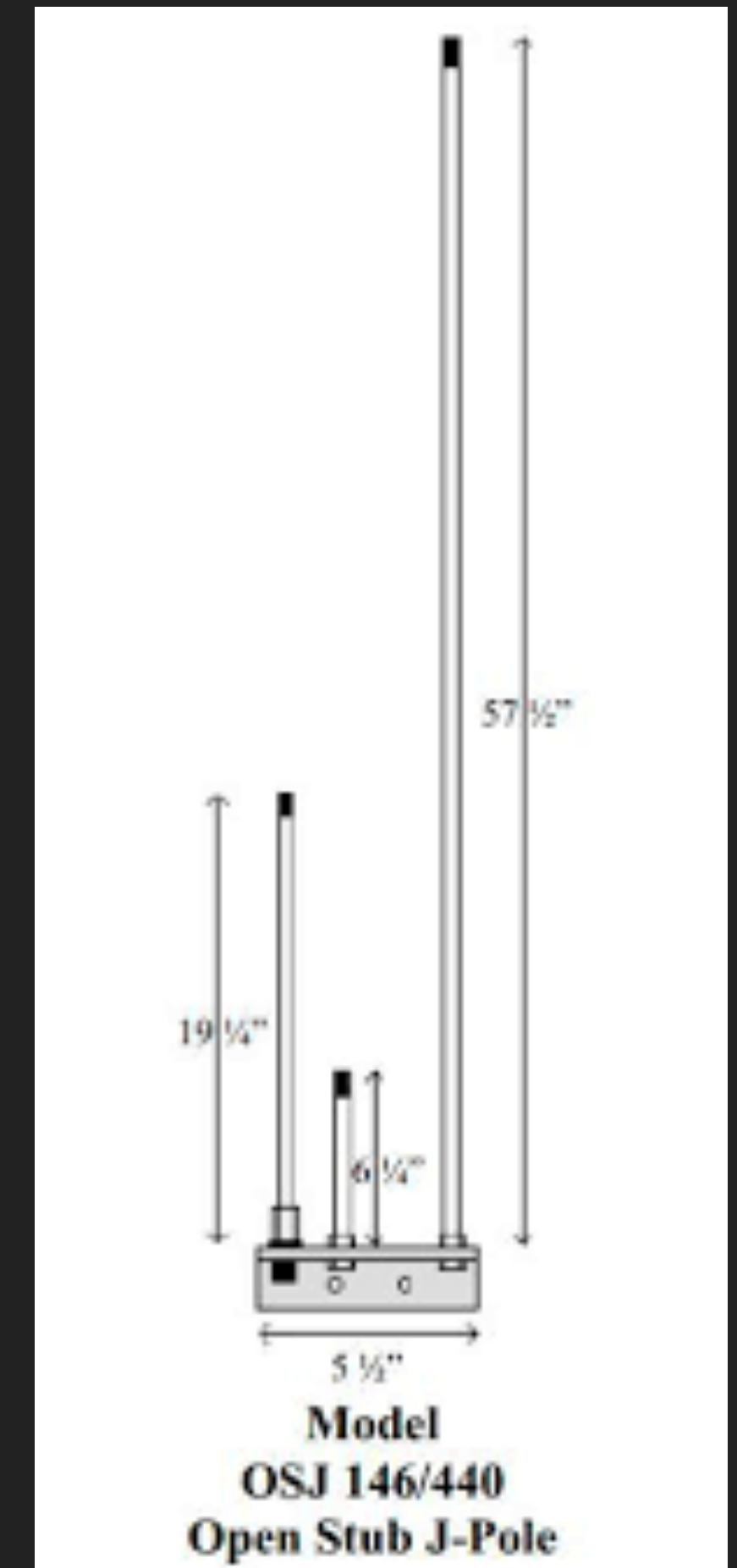
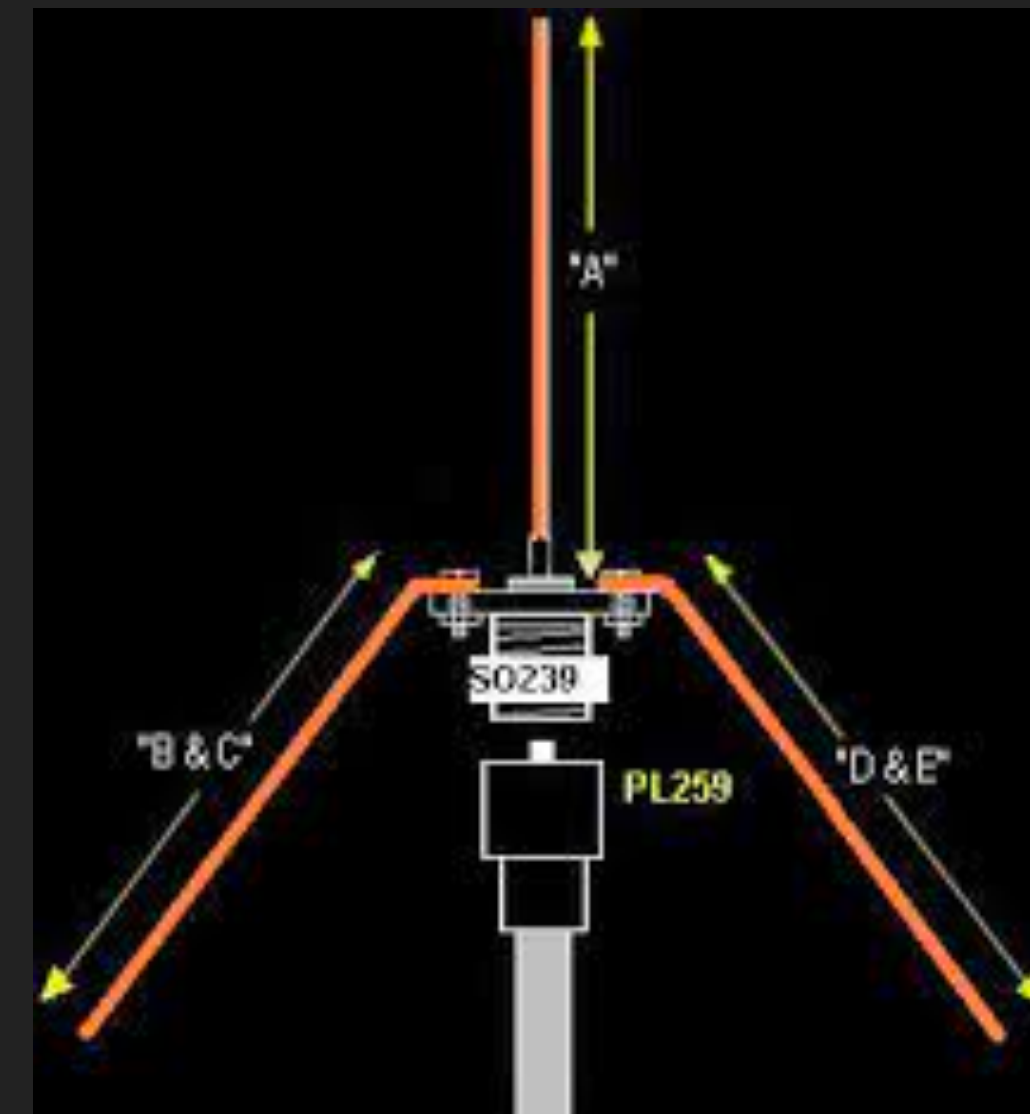
Unless you are just powering a 5 or 8-watt HT or QRP rig with external power supply, make sure power supply can handle at least 20-amps. (30amp for most HF rigs)





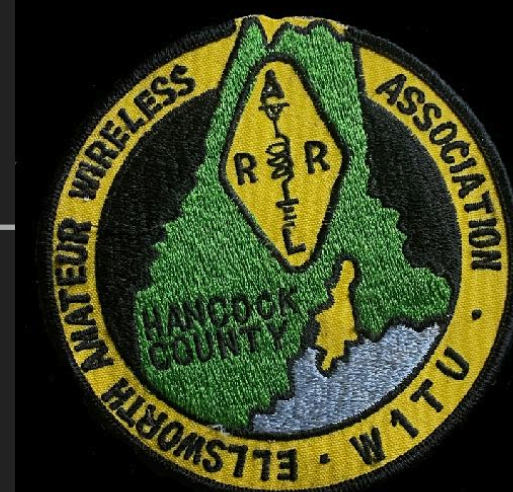
## VHF/UHF ANTENNAS

- ▶ Home Depot sells a Tram 2m/70cm antenna for around \$80.
- ▶ You can build your own dual band J-Pole antenna. Not as much gain as Tram.
- ▶ Arrow J-Pole sells a dual band j-pole for about \$70
- ▶ For 2M, you can start by building a "coat hanger" ground plane antenna.



SO-239





# TYPICAL BEGINNER VHF/UHF STATION

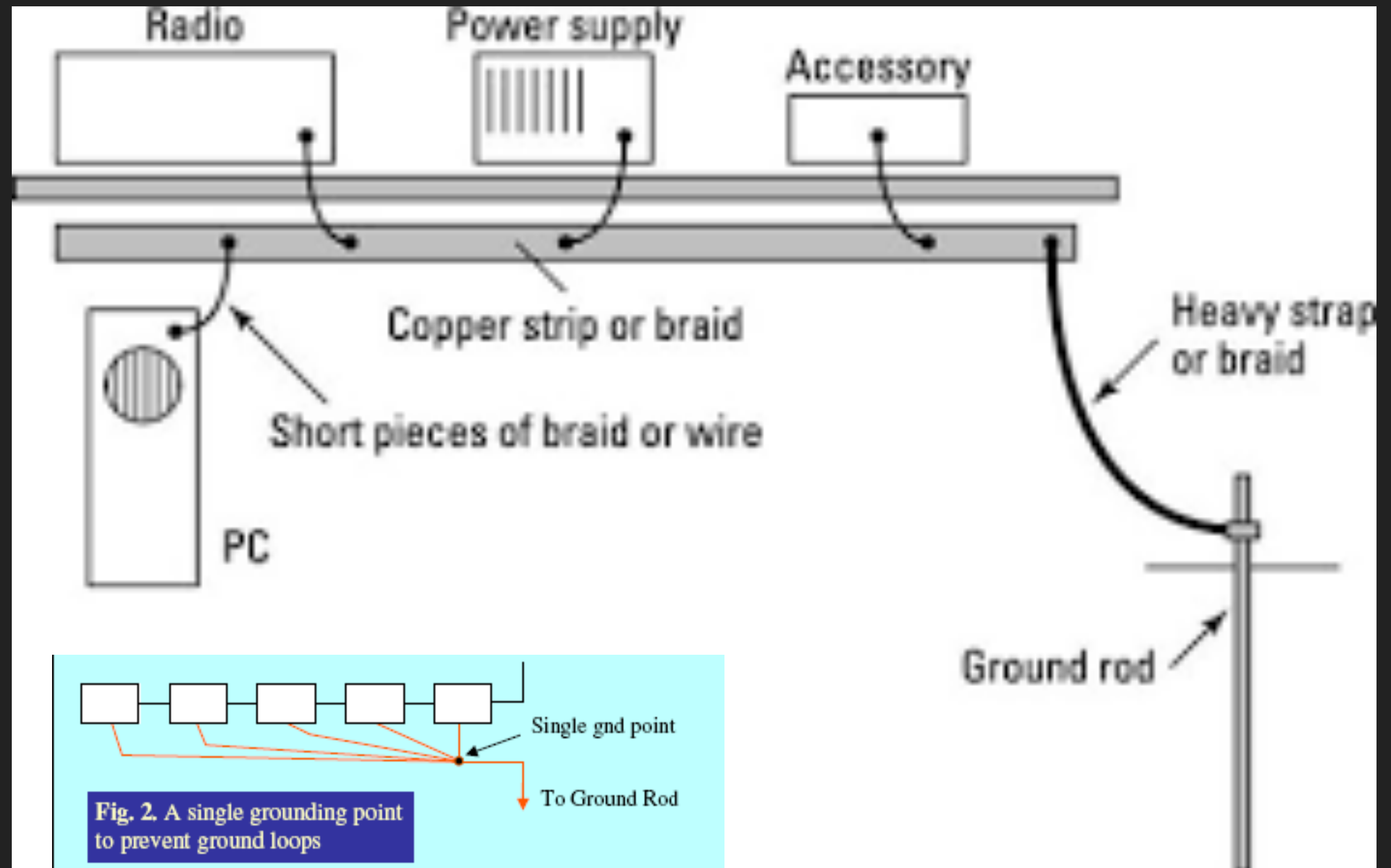






# GROUND YOUR STATION

For electrical and Radio Frequency (RF) safety you should ground your equipment in the shack as pictured.





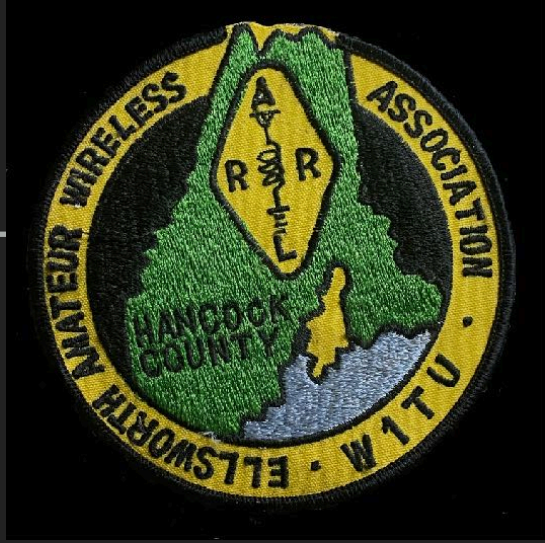


## BEGINNER VHF/UHF ANTENNAS

- ▶ Use TV masts or PVC pipes to mount your antenna upon.
- ▶ Metal masts should be grounded to a ground rod, preferably 8-foot rod, with 6 or 8 Gauge ground wire, as short a run as possible.
- ▶ There are also chimney mounts you can use.

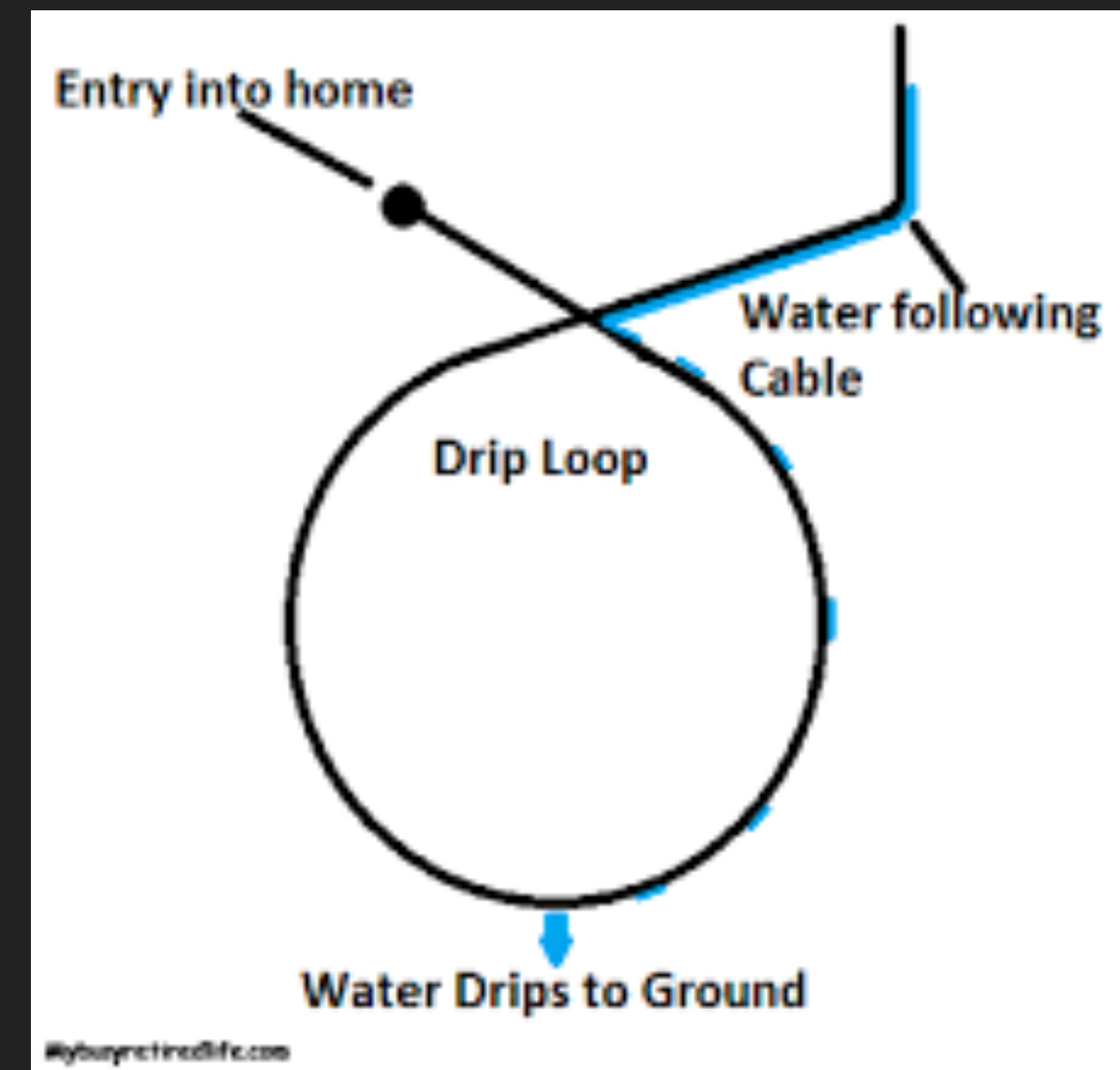






## FEEDING COAX INTO SHACK

- ▶ Use coax feed-through tubes or make your own with PVC pipe. Make sure you weather proof it, and add a coax "drip" loop outside to prevent moisture traveling into the shack along the cable.
- ▶ **WARNING!** Make sure there are no house wiring or plumbing located where you drill a hole in the wall!







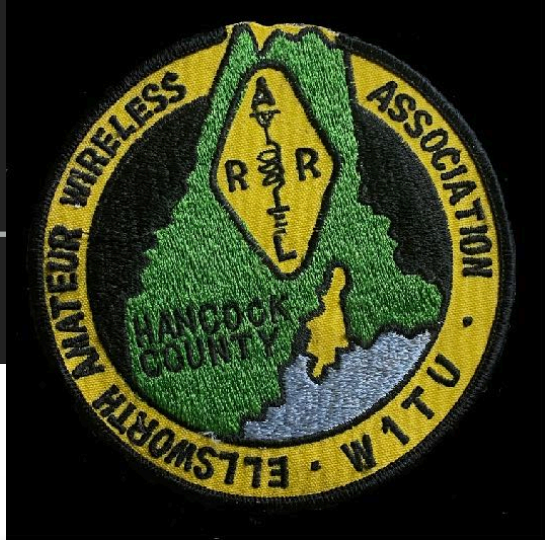
# FEEDING COAX INTO SHACK



- ▶ Window Feed-throughs are an option.
- ▶ Another option: Buried cables/pvc that run into a basement and then up to your shack.





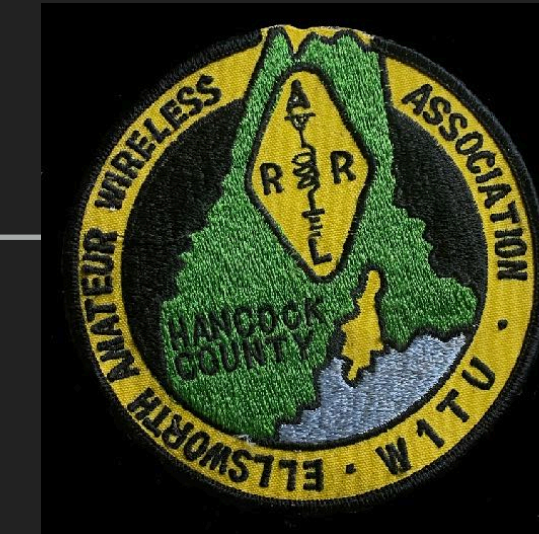


## COAX

- ▶ For VHF/UHF use low loss coax.
  - ▶ RG-8U
  - ▶ LMR-400
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- ▶ Stay away from RG-58 or RG-8X (mini) for VHF/UHF unless a short run such as portable operations outside. Too much signal loss at these higher frequencies.



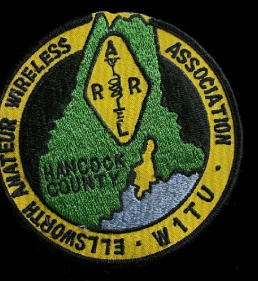




# COAX SIGNAL LOSS

Remember, a 3dB loss is HALF your power!

<i>Attenuation in dB per 100 feet</i>							
<i>Cable Group</i>	30 MHZ	50 MHZ	100 MHZ	150 MHZ	450 MHZ	1000 MHZ	2400 MHZ
<b>LMR-100A®</b>	3.9	5.1	7.2	8.9	15.8	24.1	38
<b>LMR-200®</b>	1.8	2.3	3.2	4	7	10.4	16.5
<b>LMR-240 Ultra®</b>	1.3	1.7	2.9	3.6	5.3	9.5	12.7
<b>LMR-240®</b>	1.3	1.7	2.4	3	5.2	7.9	12.7
<b>LMR-400 Ultra®</b>	0.8	1.1	1.5	1.5	3.2	5	7.9
<b>LMR-400®</b>	0.7	0.9	1.3	1.5	2.7	4.1	6.6
<b>RG-174</b>	5.5	6.6	8.8	10.3	18.1	27.4	43
<b>RG-213</b>	1	1.5	2.1	2.8	4.4	7.1	12
<b>RG-214</b>	1.2	1.6	1.9	2.4	5.1	8	13.7
<b>RG-316</b>	4.3	5.6	7.9	4.4	17.2	26.1	45
<b>RG-58A/U</b>	2.5	4.1	5.3	6.1	10.6	24	38.9
<b>RG-8/U FOAM</b>	1	1.2	1.8	2.4	4.4	7.1	12
<b>RG-8X</b>	2	2.1	3	4.7	8.6	12.9	21.6
<b>RG218/U</b>	0.4	0.6	0.8	1	2	3.8	6.4

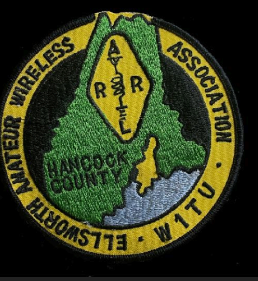


## BEGINNING HF STATION

- ▶ We are now in solar cycle 25 and conditions have been excellent for 10 meters, and will likely continue to be great for the next 4 years. Use a ten meter mobile as a base station with a simple halfway dipole and work the world!
- ▶ Technician class hams can use SSB from 28.300 to 28.500 MHz and CW from 28.000 to 28.500.
- ▶ 10M dipole can be made of tubing or wire.







## HF STATIONS

- ▶ All Mode HF Rig. Used ones go for about \$300/\$400 at hamfests.
- ▶ Entry level NEW HF rigs start at about \$600. The popular Icom-7300 goes for about \$1000 but has the qualities of an intermediate level rig. They have excellent audio.
- ▶ Most newer rigs come with an internal autotuner to help match your rig with the antenna. If the antenna is a severe mismatch, you might need a better external tuner that can handle wide mismatches.

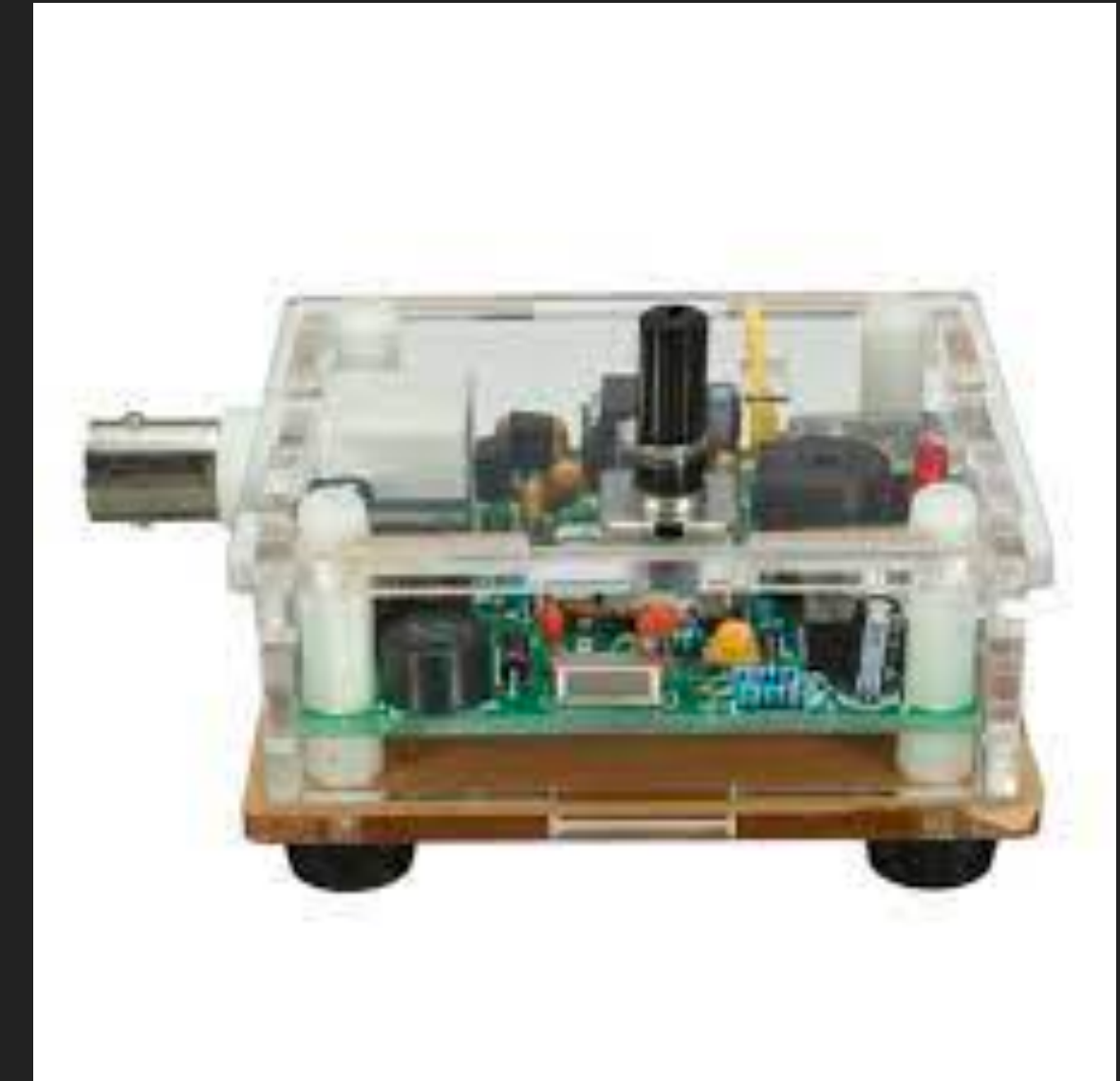




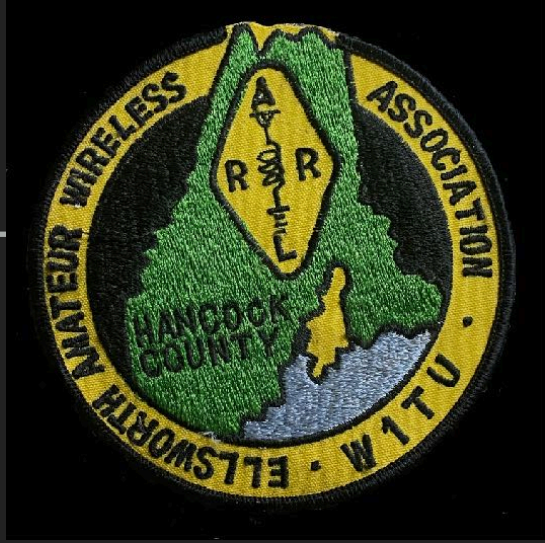


## HF STATIONS & ANTENNAS

- ▶ You can also build a simple and inexpensive transceiver kit, especially if you learn CW – the Morse code. These kits range in cost from \$10 to a few hundred, depending upon the sophistication and all the “bells and whistles” such as filters, microprocessors, electronic keys, etc.
- ▶ Technician class hams have CW privileges on segments of 80/40/15/10m on HF.

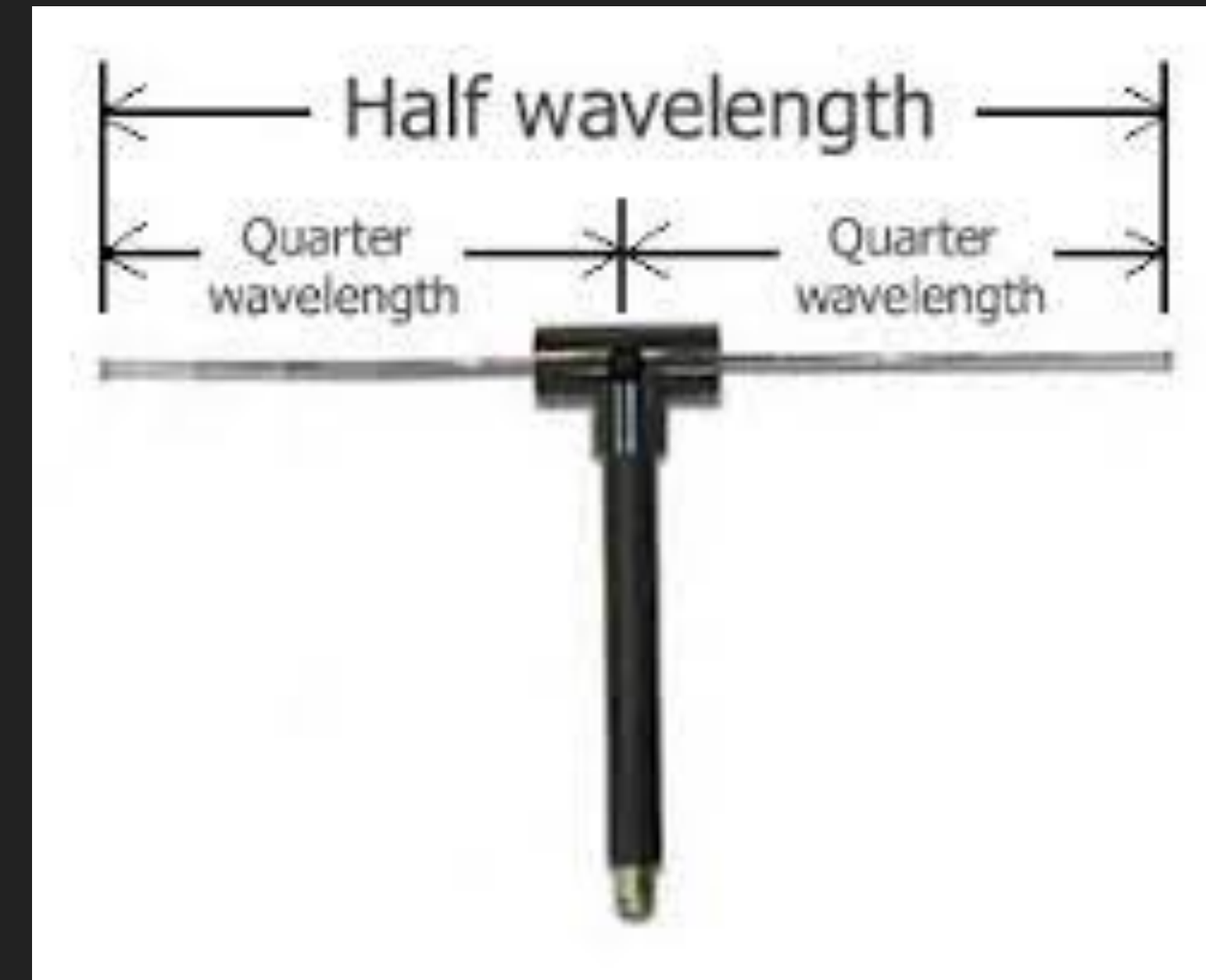




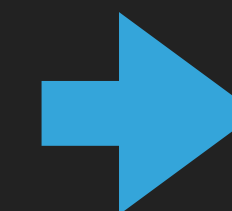


## THE DIPOLE

- ▶ Probably the simplest and most popular ham radio antenna.
- ▶ Formula to calculate the length of a dipole is  $468 \div$  frequency in MHz. So, a 10 meter dipole optimized for 28.400 MHz is  $468 \div 28.4 = 16.48$  feet total length.
- ▶ Each leg of a center-fed 10m halfway dipole would then be 8.24 feet.



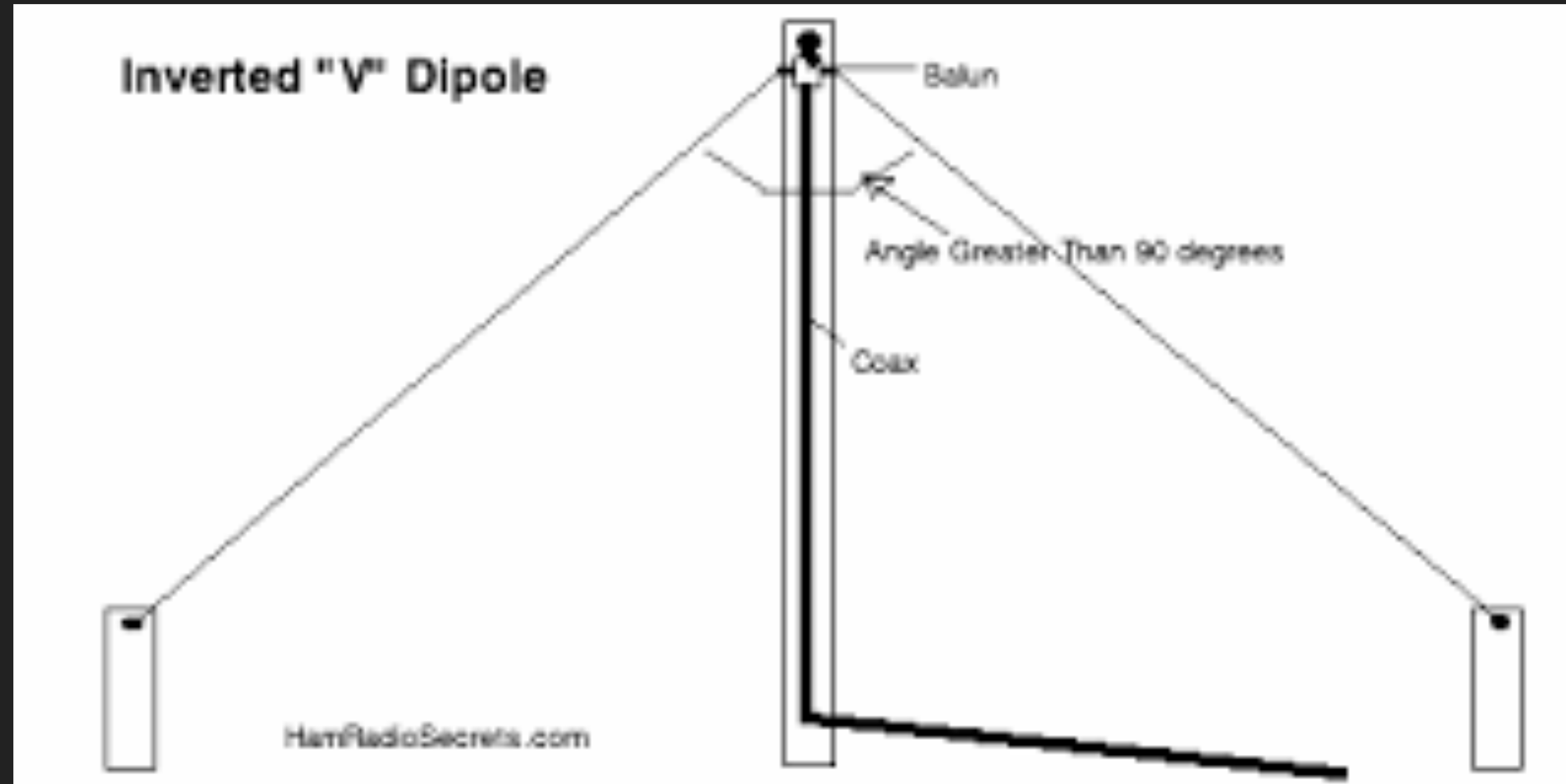
Center Insulator





## INVERTED VEE

- ▶ Still a center-fed halfwave dipole, but instead of "flattop" each leg slopes downward and center is highest height.
- ▶ Will likely need both legs to be trimmed for minimum SWR.



Use SWR meter or antenna analyzer to tune for resonance (low SWR)

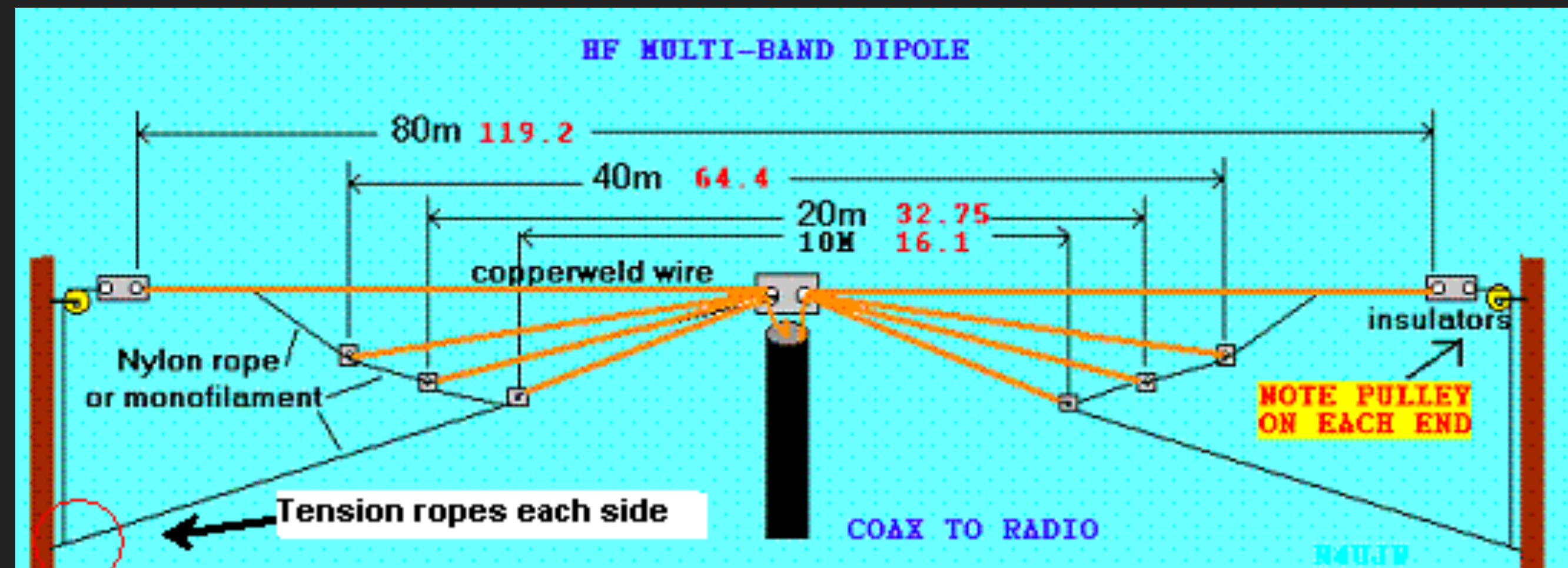
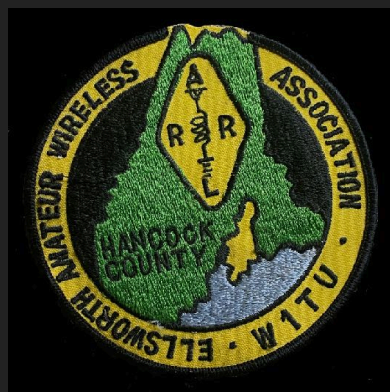


# FAN DIPOLE

- ▶ Getting on multiple bands with one antenna, and a single coax cable here.



Homemade  
Center Insulator



Tension rope is not tied to pulley rope in picture. It is tied near location of pulley rope down on supports within easy reach. It is tied last after final SWR adjustment and the antenna is in it's final position.

Suggested total lengths:  
80 meters - 120 feet  
40 meters - 65 to 66 feet  
20 meters - 34 feet  
10 meters - 17 feet

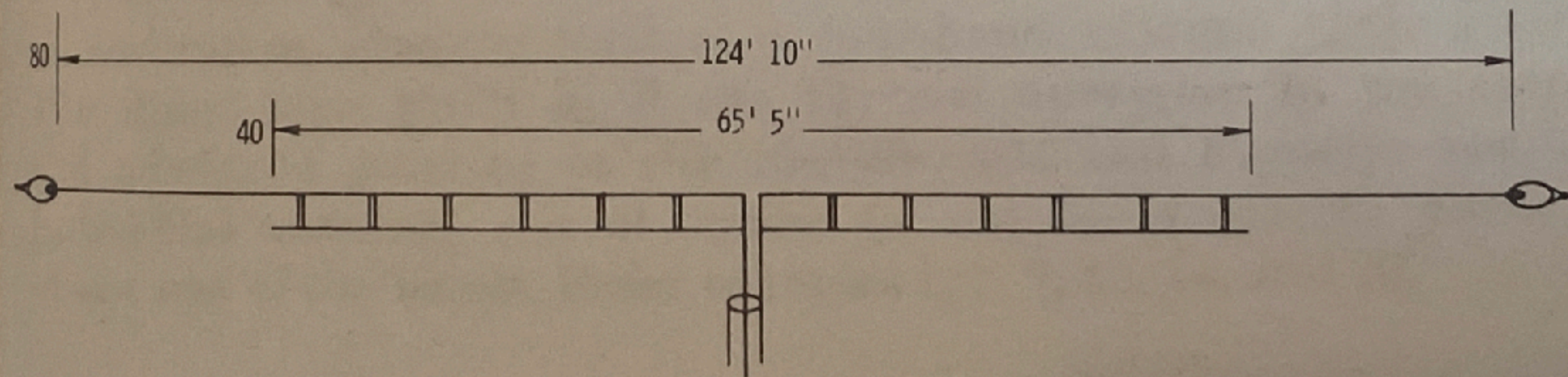
These lengths are not exact. Some tuning may be required. Use the standard formula  $468 / \text{freqmhz}$  for total feet for each band (freq) of interest. Adjust each length longer or shorter as needed.



## ANOTHER DUAL-BANDER MADE OF WINDOW-LINE

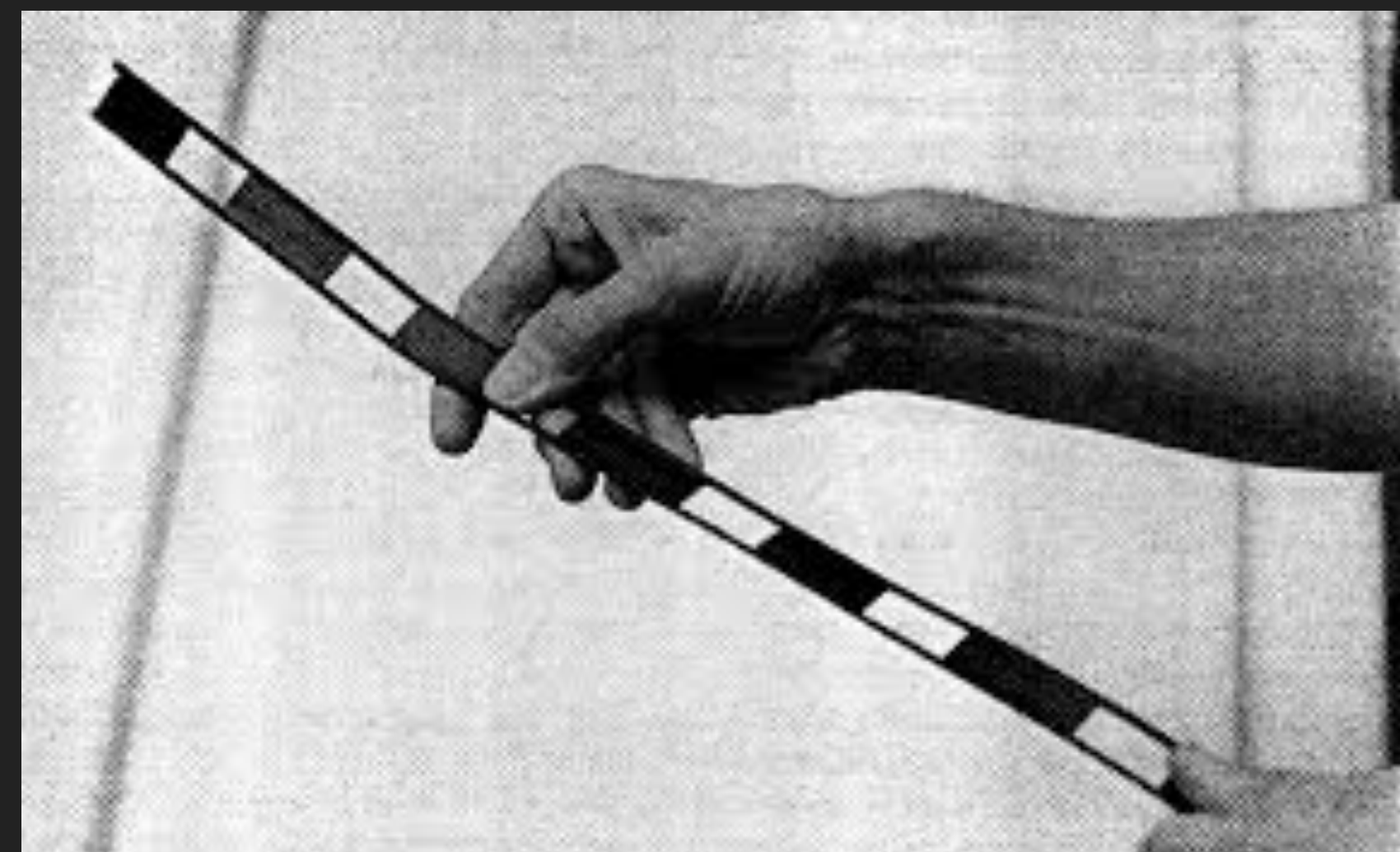
### 20 — Open-Wire Two-Band Dipole

- Open-wire transmission line, suitably cut, can be used to construct two-band antennas. The 450-ohm type is preferable because of the greater separation between conductors.

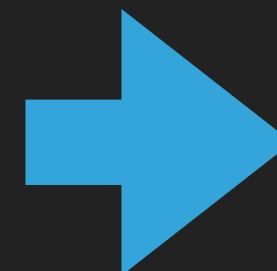


(A) 80-40 combination.

Use 450-ohm window-line to make dual-band antennas. In snowy or rainy weather, it may detune easier than a regular single insulated wire antenna.

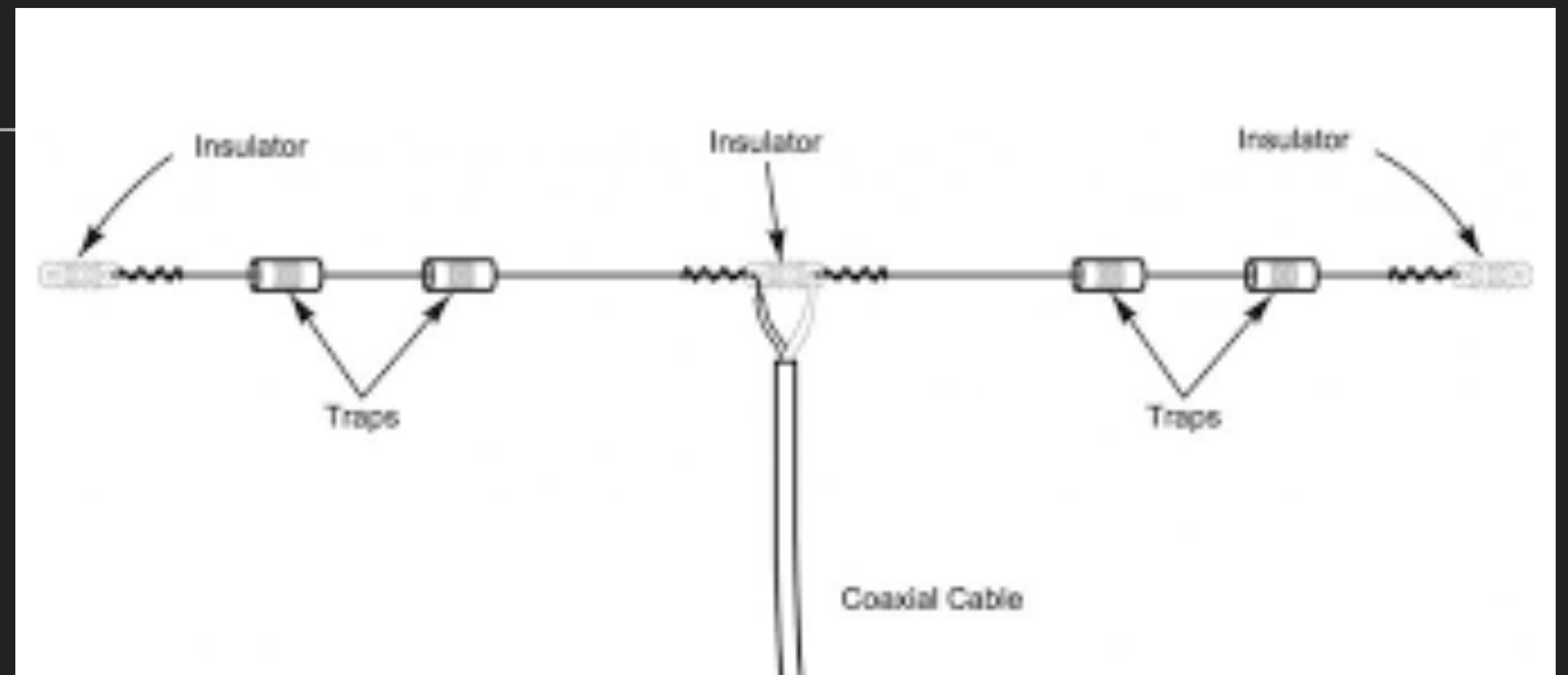


Window-line

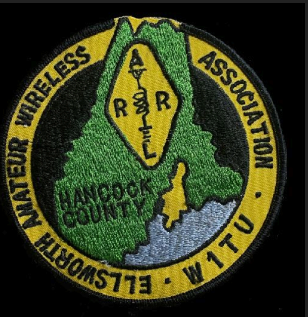




## TRAPPED DIPOLE



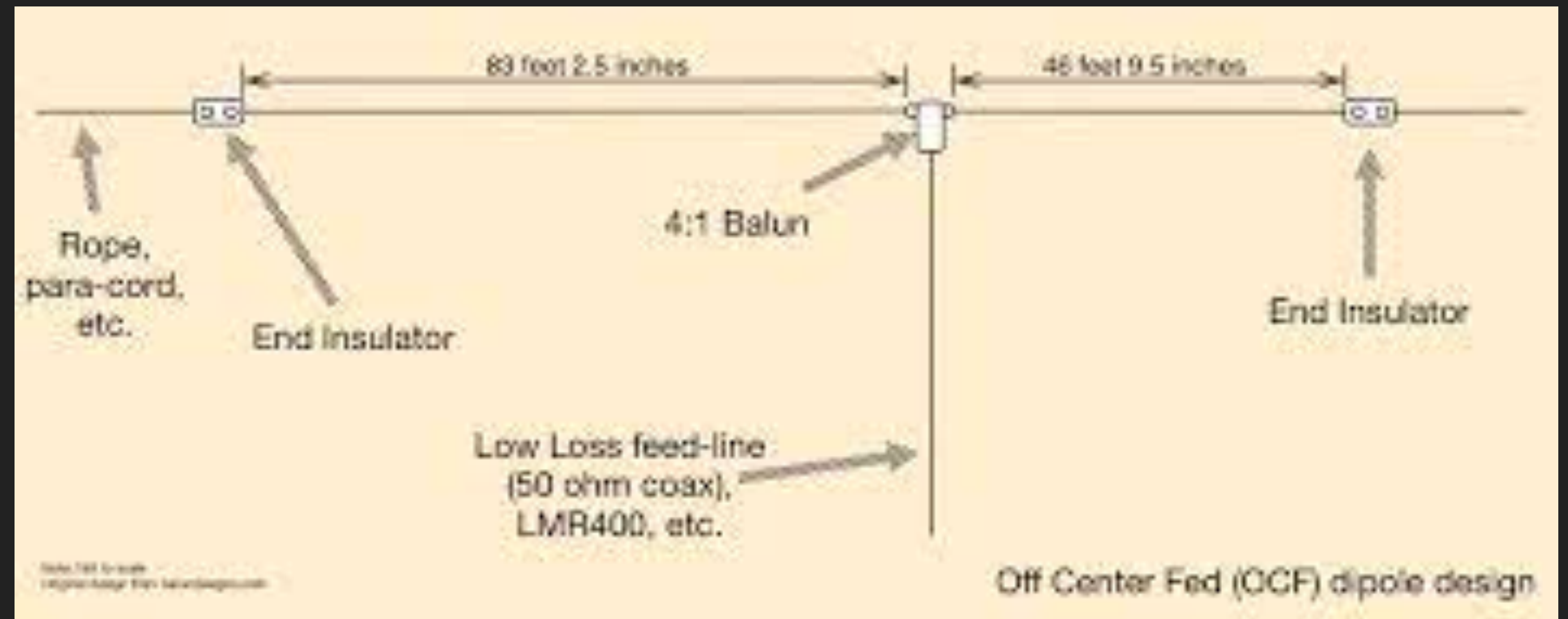
- ▶ Traps are tuned circuits that act somewhat like automatically switched inductors or capacitors, adding or subtracting from the length of the antenna according to the frequency of your signal – ARRL
- ▶ The traps allow you to use the antenna on multiple bands. Some say traps are “lossy” but I have had very good results with trapped antennas. Very convenient to have one multi band antenna and coax instead of several “mono-band” dipoles.
- ▶ However, mono-band antennas are usually more efficient.





## OFF-CENTER-FED DIPOLE

### Classic Carolina Windom



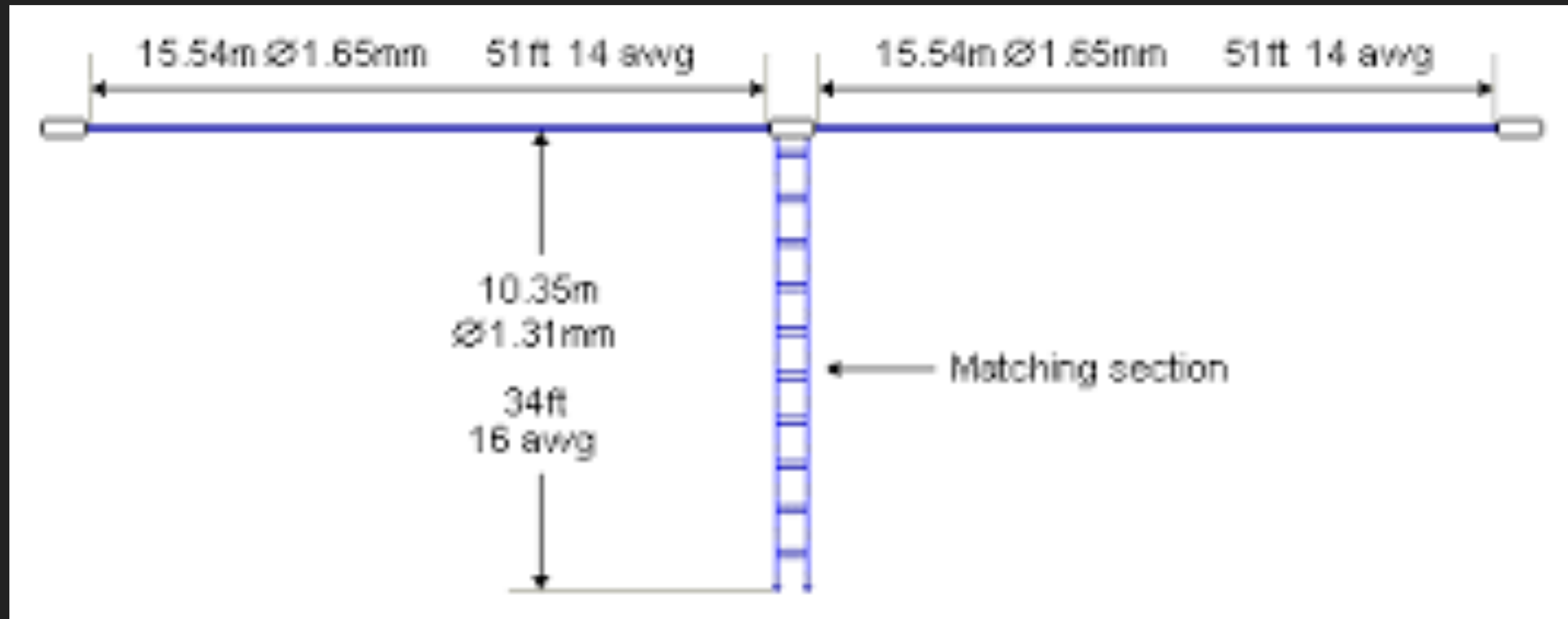
- ▶ Multiple bands in single antenna.
- ▶ May be easier to route coax to your shack.
- ▶ Must be wary of RF inadvertently getting back in to the shack causing extortion on your transmit signal.







# G5RV



10-80M

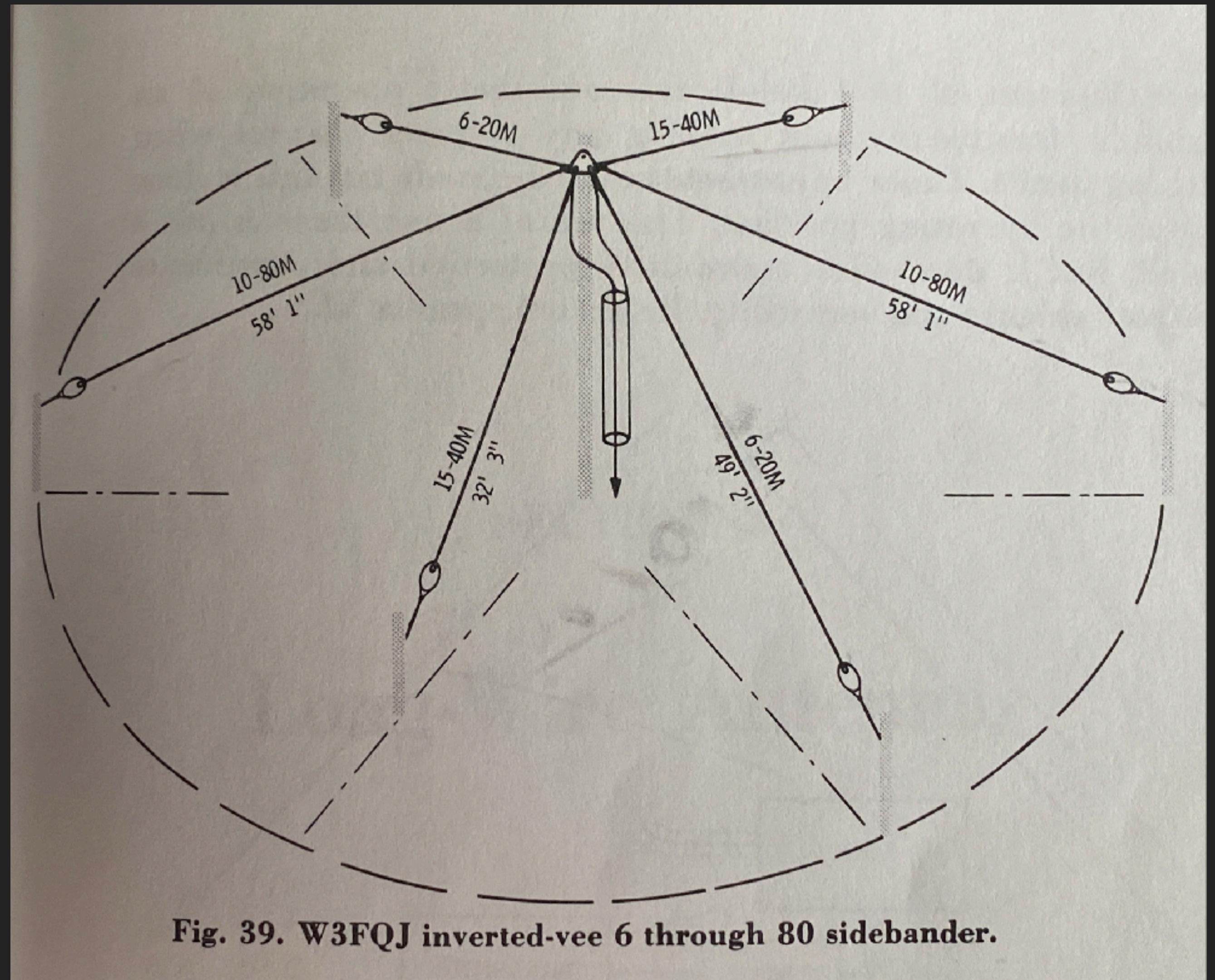
- ▶ Multiband with tuner, but optimized for 20-meters.
- ▶ There are several alternate G5RV designs, but this is the original.
- ▶ Some have a line isolator at bottom of matching section, and then fed rest of the way with coax.





## SINGLE SIDEBANDER MAYPOLE! 6 THRU 80M

- ▶ Need about a hundred feet diameter area to set up.
- ▶ Center should be at about 35-foot height.
- ▶ Ends should be 6 to 10 feet above the ground. Secured by poles or tree limbs.
- ▶ 6-band Inverted V !!!



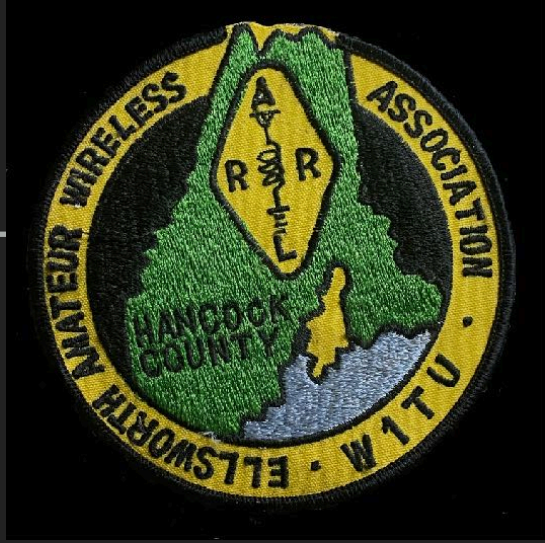




## COAX FOR HF

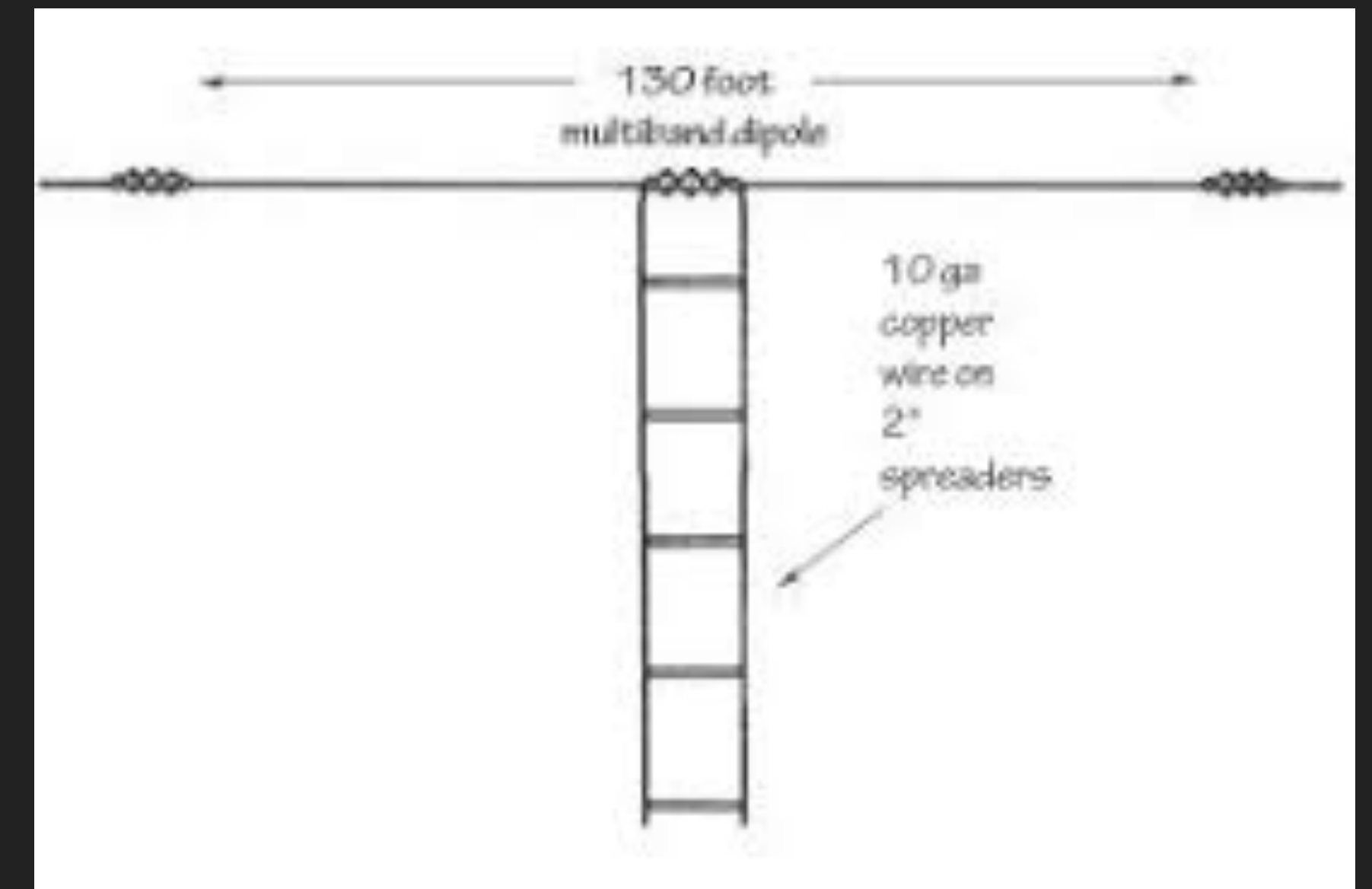
- ▶ For the higher frequency HF bands, such as 20 through 10 meters, use low loss coax if possible. RG-8U or RG-213 has less line loss per 100 Feet than RG-58 or RG-8X.
- ▶ For 40 meters (7MHz) and lower frequencies, there is not much signal loss so RG-58 or RG-8X is fine unless you intend to use high power, such as a kilowatt amplifier.





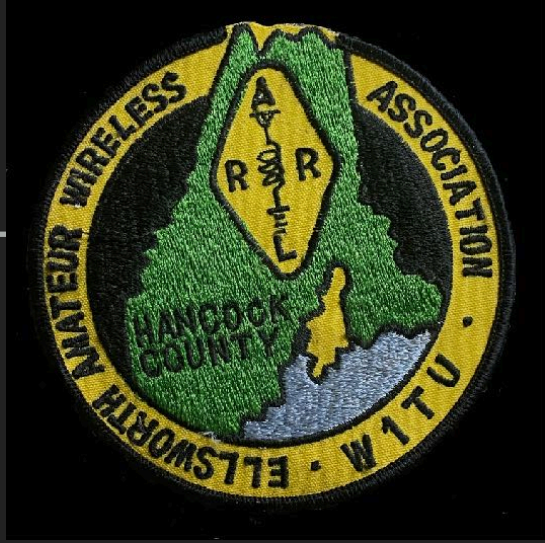
## OPEN-LINE VS COAX

- ▶ Many hard core experienced hams, especially on the lower frequencies, swear by 600  $\Omega$  ladder line or open-line as transmission lines, instead of coax. But there are some complex issues you need to address if you are going to use these balanced, non-shielded feed-lines.



This is not typically part of a Beginner Station.





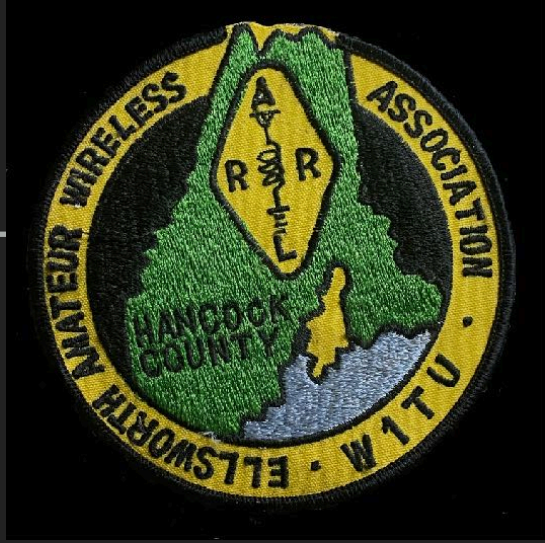
## BALUNS

- ▶ Balance to Unbalance.
- ▶ Center-fed half-wave dipoles do not require a balun, but they may help reduce noise, and are convenient to connect antenna wire and coax. A 1:1 balun could be used in these cases.
- ▶ Some off-center fed, end-fed, loops, and beams may use other types of baluns or "ununs." A 4:1 current balun is common for some loop antennas. End-feds often call for a 9:1 or a 49:1 unun.



allows balanced and unbalanced lines to be interfaced without disturbing the impedance arrangement of either line.



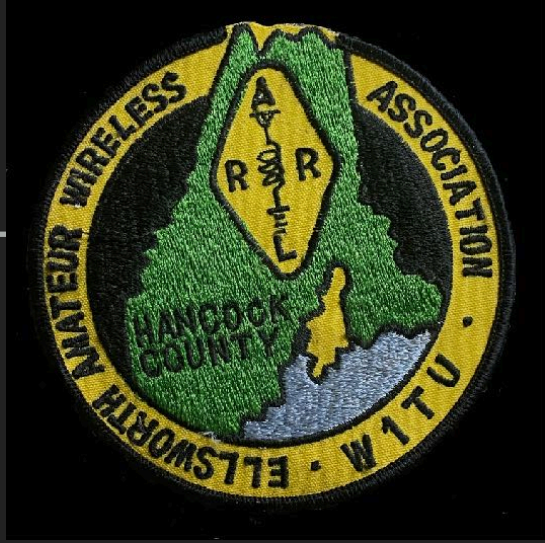


## RF CHOKE BALUN

- ▶ Put this up towards the feed point of the antenna.
- ▶ Can reduce SWR
- ▶ Helps prevent Radio Frequency Interference and RF feedback
- ▶ Helps reduce RF noise.
- ▶ Charts showing how many winds, what type of coax.





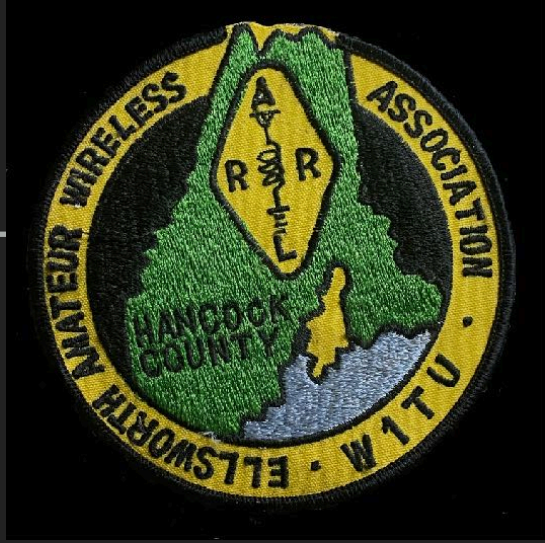


# RF CHOKES

## Single Band

<b>FREQ/MHz</b>	<b>RG213, RG8</b>	<b>RG-58</b>
3.5	22ft, 8 turns	20ft, 6-8 turns
7	22ft, 10 turns	15ft, 6 turns
14	10ft, 4 turns	8ft, 8 turns
21	8ft, 6-8 turns	6ft, 8 turns
<b>28</b>	<b>6 ft, 6-8 turns</b>	<b>4ft, 6-8 turns</b>





# RF CHOKES

## Multiband

<b>FREQ/MHz</b>	<b>RG8, 58, 59, 8x, 213</b>
3.5 to 30	10ft, 7 turns
3.5 to 10	18 ft, 9 - 10 turns
1.8 to 3.5	40ft, 20 turns





## WEATHER PROOF!

- ▶ For outside coax connectors to the antenna feed point, make sure you weather-proof it. Get good quality 3M electrical tape and wrap several loops around the connections point.
- ▶ For permanent installations, also add, over the layer of electrical tape, special waterproof gunk tape or silicon.

DX Engineering DXE-33PLUS - Scotch® Super 33+.



Don't forget to weatherproof connections to any RF chokes or other coax connections.



## REFERENCES

- ▶ 73 Dipole and Long-wire Antennas by Edward M. Roll W3FQJ
- ▶ The ARRL Handbook For Radio Communications 2023