

# QRP Presentation

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# QRP Presentation

## John Meade W2XS

- Topics
  - Philosophy of QRP
  - Equipment
  - Antennas
  - Power Supplies

# QRP Philosophy

- Operating at 1 to 5 watts can be fun and addictive.
- The results are surprising when the band is open.
- QRP does not necessarily have to “replace” QRO. Do both!
- Operate from the back yard or a park bench.



# QRP Philosophy

Look at how much fun I'm having!





# QRP Philosophy At the park





# QRP Philosophy

## The pole is there somewhere





# QRP Philosophy

- Even simple QRP rigs will provide fun and satisfaction.
- The lower the current drain, the longer the batteries will last.
- Many QRP rigs are simple but high performance.
- Put up the best antenna possible.

# QRP Calling Frequencies

<b>Table 11-5 North American QRP Calling Frequencies</b>		
<i>Band (Meters)</i>	<i>Morse Code (MHz)</i>	<i>Voice (MHz)</i>
160	1.810	1.910
80	3.560	3.985
	3.710	
40	7.040	7.285
	7.110	
30	10.106	
20	14.060	14.285
17	18.096	
15	21.060	21.385
	21.110	
12	24.906	
10	28.060	28.885
	28.110	28.385
6	50.060	50.885
2	144.060	144.285 (SSB)
		144.585 (FM)



# QRP Resources

<i>Resource</i>	<i>Address or Source</i>	<i>Description</i>
QRP Amateur Radio Club, International	<a href="http://www.qrparci.org">www.qrparci.org</a>	<i>QRP Quarterly</i> magazine and numerous awards
American QRP Club	<a href="http://www.a-qrp.org">www.a-qrp.org</a>	Extensive kit-building and construction resources, <i>Homebrewer</i> magazine
G-QRP Club	<a href="http://gqrp.com">gqrp.com</a>	Lots of building and operating information, <i>SPRAT</i> magazine
Adventure Radio Society	<a href="http://www.arsqrp.com">www.arsqrp.com</a>	Emphasis is on portable operation
QRP-L e-mail reflector	<a href="mailto:listserv.1ehigh.edu/lists/qrp-1">listserv.1ehigh.edu/lists/qrp-1</a>	Best-known QRP e-mail reflector, includes archives for e-mail, files, and articles
QRP forum	<a href="http://www.eham.net/forums/QRP">www.eham.net/forums/QRP</a>	Wide variety of topics
Magazine columns about QRP	<i>QST</i> "QRP Power," <i>Worldradio</i> "QRP"  <i>CQ Magazine</i> "QRP"	A different technical or operating topic with every issue



# **QRP HISTORY**



# QRP History Highlights

- 1927 to 1970
  - Many homebrew QRP articles published
  - W1FB – Prolific writer – founded OHR
- 1969
  - Ten Tec introduced the Power-Mite modules
- 1972
  - Ten Tec Argonaut Model 505
  - MFJ Audio Filter came out
- 1973
  - Heathkit HW-7
- 1976
  - Heathkit HW-8

# QRP History Highlights

- 1980
  - W7EL's Optimized Transceiver article
- 1994
  - K1SWL Dave Benson's NE4040 (SWL40+)
- From N6KR:
  - 1993 – NorCal 40
  - 1994 – NorCal Sierra
  - 1997 – SST
  - 1999 – Started Elecraft (K2 then K1 ...)
- Rick Littlefield K1BQT
  - Designed the MFJ Cub and 90X0 series





**EQUIPMENT**

# K2 - The Old King of QRP Rigs

Need just a paddle and an antenna





# KX2 - The New King of QRP Rigs Need just an antenna









# Everything That You Need!



# QRP Equipment

- Specifications

- Bands covered – mono or multi
- Power Output - fixed or variable
- Selectivity – fixed or variable
- Sensitivity – most are “good enough”
- Stability – drift is annoying



# QRP Equipment - Bands

- 40m and 30m are popular QRP bands.
- 20 thru 10 are great QRP bands when open
- I've had good results on 80m too
- Some people operate QRP on 160m
- Antennas might be an issue on 80 and 160

# QRP Equipment - Power

- 2W or 3W is fine for a QRP rig.
- A 2x increase in power is only 3 dB which is barely noticeable.
- A 10x increase in power is 10 dB which is only 2 "S" units.
- Receiver current drain is important when using batteries.



# QRP Equipment - Selectivity

- Many QRP rigs have sharp but fixed filters.
- I like to use the widest bandwidth possible and make it narrower as needed.
- Some filters are variable.

# QRP Equipment - Sensitivity

- RF and IF amplifiers are not really needed.
- Many rigs use just the NE602-LM386 ICs.
  - SST, SWL40+, KX1, K1
- Headphone volume is ample enough.
- External audio amplifiers can be used.



# QRP Equipment - Stability

- The simplest rigs are xtal controlled.
- Some have a VCXO.
- Some have tuning capacitors
  - OHR400 – a bit drifty
- Many have varactor diodes for tuning.
  - SWL40+ = 70 kHz
  - SST40 = 15 kHz (2 ranges)
  - OHR100A = 70 kHz
  - A 10-turn pot can be installed – I use “Knobpots” on many QRP rigs.

OHR100A

Knob	Freq
0.0	7003.6
1.0	7007.2
2.0	7013.1
3.0	7020.7
4.0	7029.6
5.0	7039.4
6.0	7048.9
7.0	7058.3
8.0	7066.8
9.0	7074.7
10.0	7081.8

**BANDWIDTH**

WIDE NAR

**RF GAIN**



20 30 40 50 60 70

0 10

0 1 2 3 4 5 6 7 8 9 10

OFF

OHR 100A  
Oak Hills Research



This was the calibration chart for my OHR100A with the 10-turn Knobpot

OHR100A

Knob	Freq
0.0	7003.6
1.0	7007.2
2.0	7013.1
3.0	7020.7
4.0	7029.6
5.0	7039.4
6.0	7048.9
7.0	7058.3
8.0	7066.8
9.0	7074.7
10.0	7081.8

# THERMO-PROBE

MICRO TECHNICAL INDUSTRIES

MODEL 35AB



OFF

DEGREE C



HEATER

POWER





# State of the Art QRP – 1980's





# Argonaut 515 - Was Good in its Time

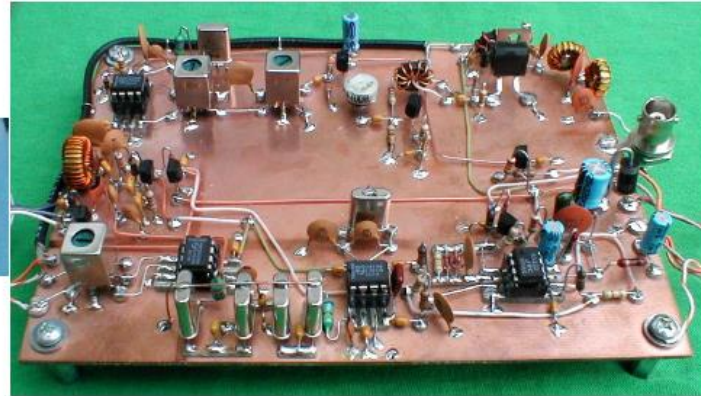


# QRP Equipment - Stability

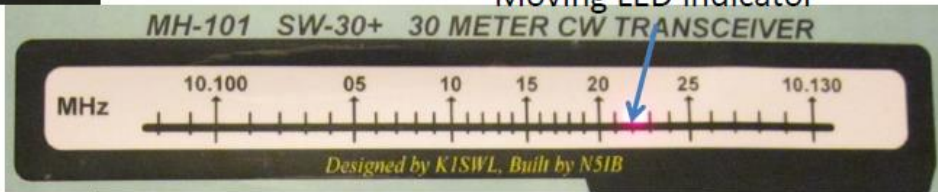
- Some are synthesized for rock-solid stability:
  - Elecraft KX1, KX2, KX3, and K2
  - Ten Tec's 40/20 or 40/30 (HB1A copies)
  - LNR MTR series



# A Nice Homebrew Example



Moving LED indicator



SW-30+ built Manhattan style and Enclosed in a retro-look poplar box.



This takes 100W to operate! State of the art in 1955.





# My Favorite QRP Paddles

- Paddlette Model PK-1
  - No vertical arm movement (which is good)
- Black Widow – a kit
- Scorpion – also a kit
- K9LU Bulldog – made from a paper clip
- Vibroplex Code Warrior – K8FF Design

Simple! But it works!





The KX1 Paddle was a bit hard to get used to



A wide-angle photograph of a calm, deep blue ocean stretching to the horizon. The sky is a lighter blue with wispy white clouds. A bright reflection of the sun is visible on the left side of the water. The word "POWER" is written in a bold, white, sans-serif font in the lower-left quadrant of the image.

**POWER**



# QRP Equipment - Power

- The K2 has a 2.9 AH battery and draws 200 mA in receive
  - That's 14.5 hours
- The SST draws 15 mA and I have a 2.0 AH battery
  - That's 133 hours
- The KX2 can be set for 135 mA in RX

# QRP Equipment - Power

- Approximate capacities:
  - AAA Battery = 1 AH
  - AA Battery = 2 AH
  - C Battery = 6 AH
  - D Battery = 11 AH



# QRP Equipment - Power

- RF Output Power vs. DC Input Power
- Typical Rig on Transmit:
  - Out = 100W
  - In =  $14V \times 20A = 280W$
  - 36% Efficiency
- Typical QRP Rig on Transmit (K1):
  - Out = 5W
  - In =  $14V \times 800 \text{ mA} = 11.2W$
  - 45% Efficiency
- Operating a 100W rig at 5W may be 10% efficient

A wide-angle photograph of a calm, deep blue ocean stretching to the horizon. The sky is a lighter blue with wispy white clouds. A bright, shimmering reflection of the sun is visible on the left side of the water's surface. The overall scene is serene and expansive.

**ANTENNAS**



# QRP Antennas

- Laws of Physics

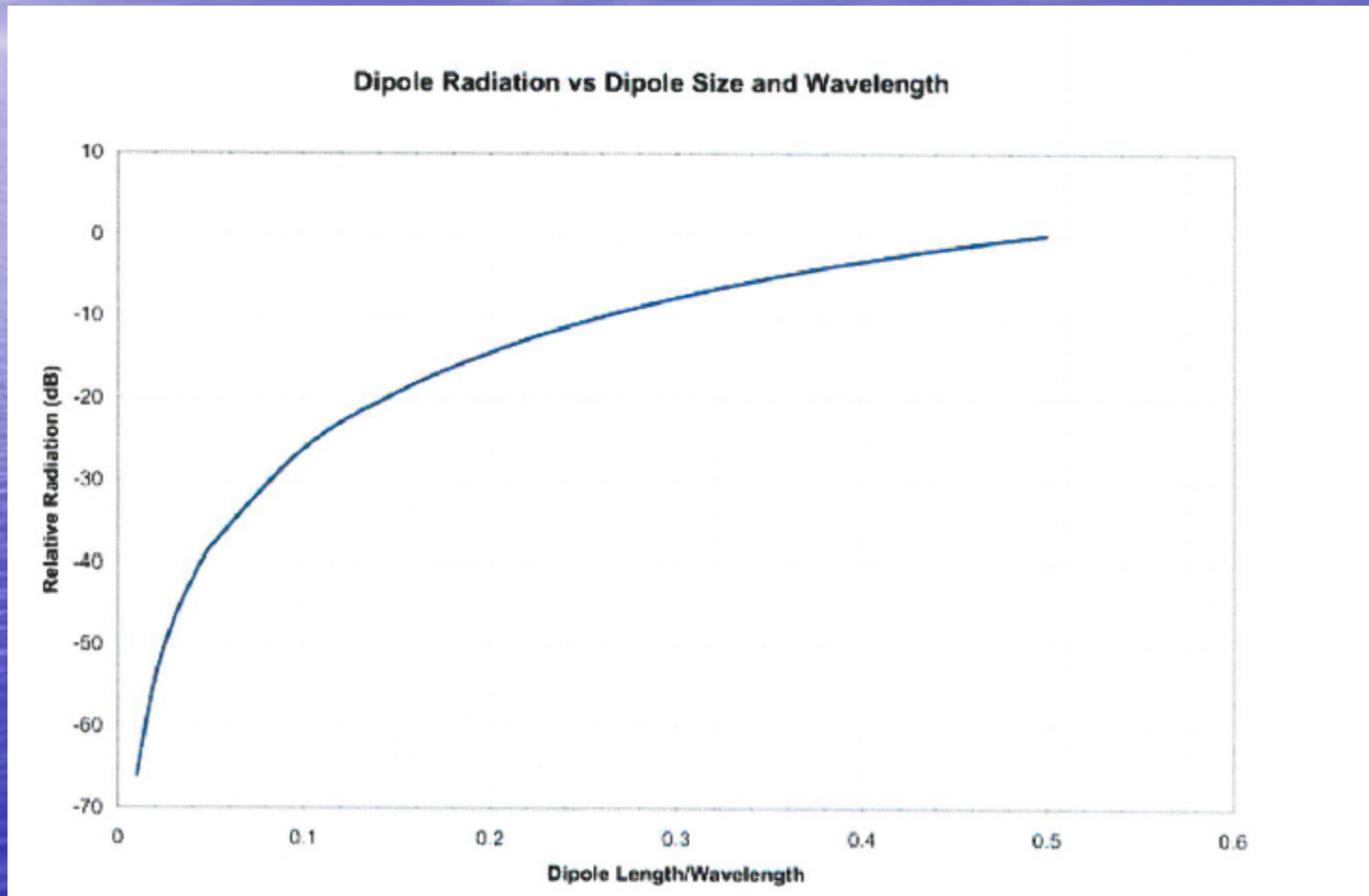
- We are trying to radiate a radio wave
- The length of the wave depends on the frequency:
  - A Frequency of 7 MHz is a Wavelength of 40 meters
  - Half wave means 20 meters = 66 feet
- A typical basic antenna is a half-wave dipole.
  - The reference for all other antennas
  - Can be fed in the center, at the ends, or off-center

# QRP Antennas

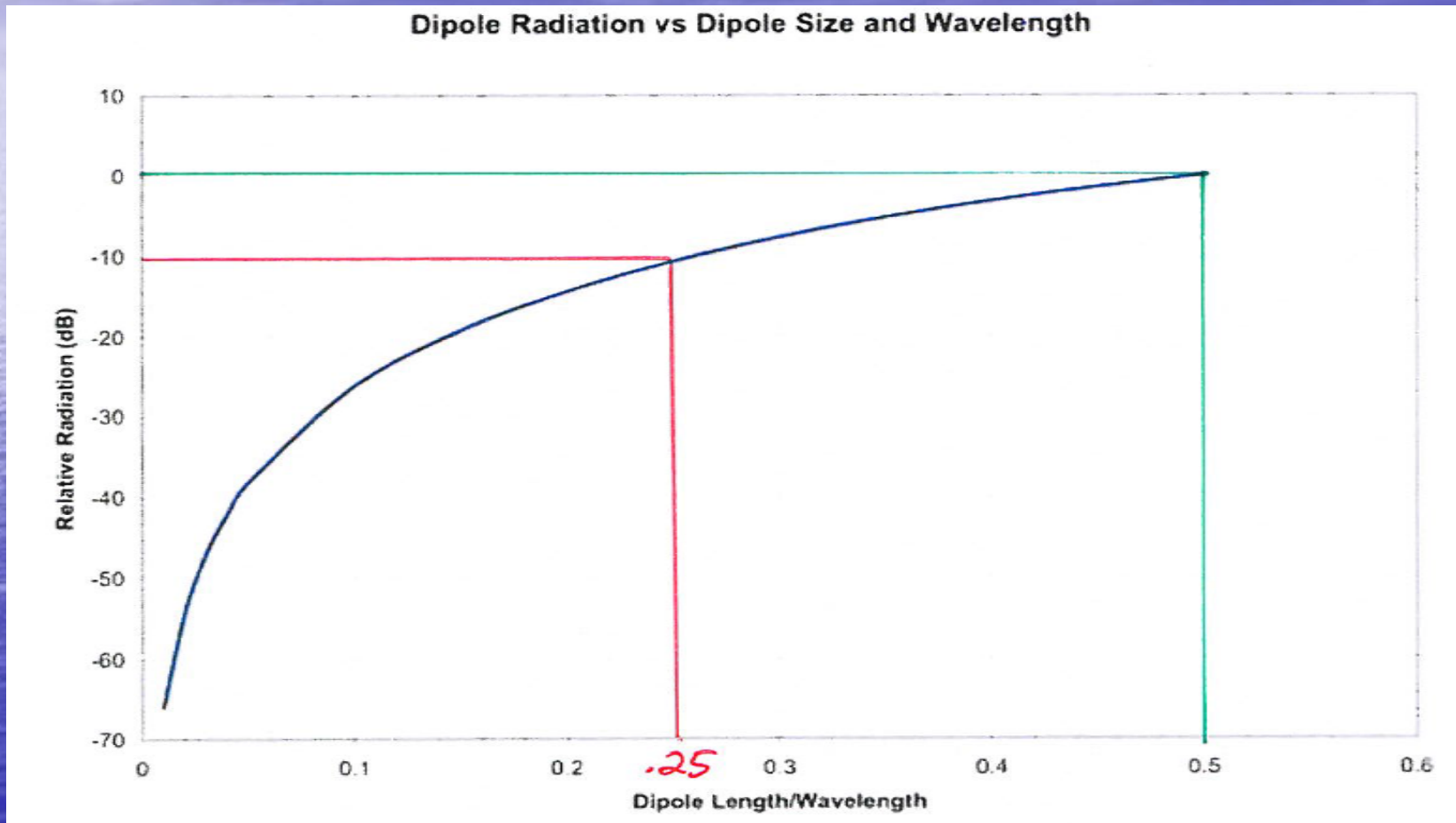
- Laws of Physics (cont)
  - In order to radiate, a “standing wave” is needed on the antenna.
  - A standing wave should not be present on the transmission line.
  - If the antenna is too short, then the standing wave will form on the antenna AND the transmission line AND the tuner – resulting in a poorly radiated signal.



# Here's an eye-opening chart:



# I drew some lines:





# Antenna Length vs. Radiation

- This indicates that a half-sized antenna radiates 10 dB less than a full-sized half-wavelength wire
- -10 dB is like having a 10 watt transmitter but radiating only 1 watt of power.
- 9 of the 10 watts are not radiated!

# QRP Antennas

- Universal antenna properties:
  - Radiation resistance
  - Loss Resistance
  - Feed point impedance
  - Dependence on ground
  - Radiation pattern
  - Gain
  - Efficiency



# Antennas

- Popular Antenna Types:
  - Dipole (CF, OCF, EF)
  - Loop
  - Vertical
  - “Random” Wire
  - Beam (Yagi)
  - Quad

### Portable 40m to 10m Inverted V Antenna used by W2XS

Jackite 31-foot pole and ground mount (or, bungee-cord it to a table or deck railing):

[http://www.jackite.com/product\\_info.php?products\\_id=132](http://www.jackite.com/product_info.php?products_id=132)

Coleman camping reel. Buy 4 of them. Use two for the antenna wire (I use 33 feet on each side but you can 22 feet and above for 40m to 10m). Use the other two as ropes to secure the antenna ends to the ground stakes.

[http://www.mysimon.com/9015-11034\\_8-30962052.html](http://www.mysimon.com/9015-11034_8-30962052.html)



Two tent stakes to secure the rope ends:

<http://www.campmor.com/webapp/wcs/stores/servlet/CategoryDisplay?categoryId=7310&storeId=226&catalogId=40000000226>

300-ohm twin lead for the feed line. I bought 50 feet from Radio Shack.

I use a small piece of Plexiglas for the center insulator with a small hole drilled in it. I use a twist-tie to secure it to the ring on the top section of the pole.

BLT Tuner (or equivalent set up. I use the K2 internal tuner and a BL1 balun):

[http://www.qrpkits.com/noxal\\_blt.htm](http://www.qrpkits.com/noxal_blt.htm)

It works very well on 40m to 10m. It takes about 10 minutes to set it up or take it down. The camping laundry-line reels make this a breeze.



# Portable 40m to 10m Inverted V Antenna used by W2XS

- Jackite 31-foot pole and ground mount (or, bungee-cord it to a table or deck railing).
- Coleman camping reel. Buy 4 of them. Use two for the antenna wire (I use 33 feet on each side but you can 22 feet and above for 40m to 10m). Use the other two as ropes to secure the antenna ends to the ground stakes. Walmart, etc., sells these things.
- Two tent stakes to secure the rope ends.

# Portable 40m to 10m Inverted V Antenna used by W2XS

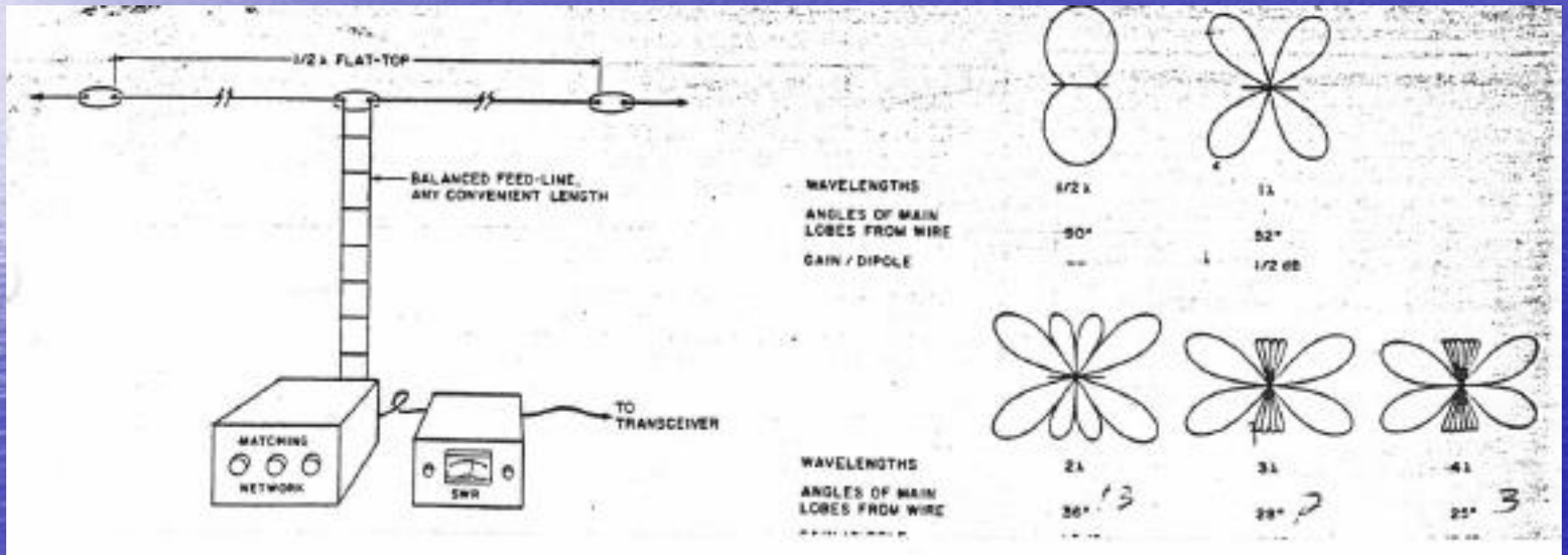
- 300-ohm twin lead for the feed line. I bought 50 feet from Radio Shack.
- I use a small piece of Plexiglas for the center insulator with a small hole drilled in it. I use a twist-tie to secure it to the ring on the top section of the pole. I have also used a small PVC pipe coupling section from the local hardware store.
- Pole mounting: The Earthworm. Jackite sells a mount also.
- BLT Tuner (or equivalent set up. I use the K2 internal tuner and a BL1 balun).



# Portable 40m to 10m Inverted V Antenna used by W2XS

- When you use a dipole on its design frequency, the radiation pattern is broadside to the wire.
- When you use a dipole on higher frequencies, lobes are formed in the radiation pattern.

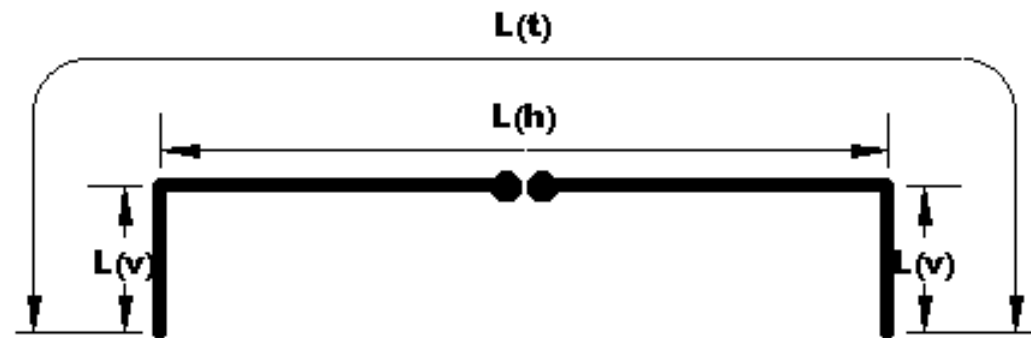
# QRP Antennas





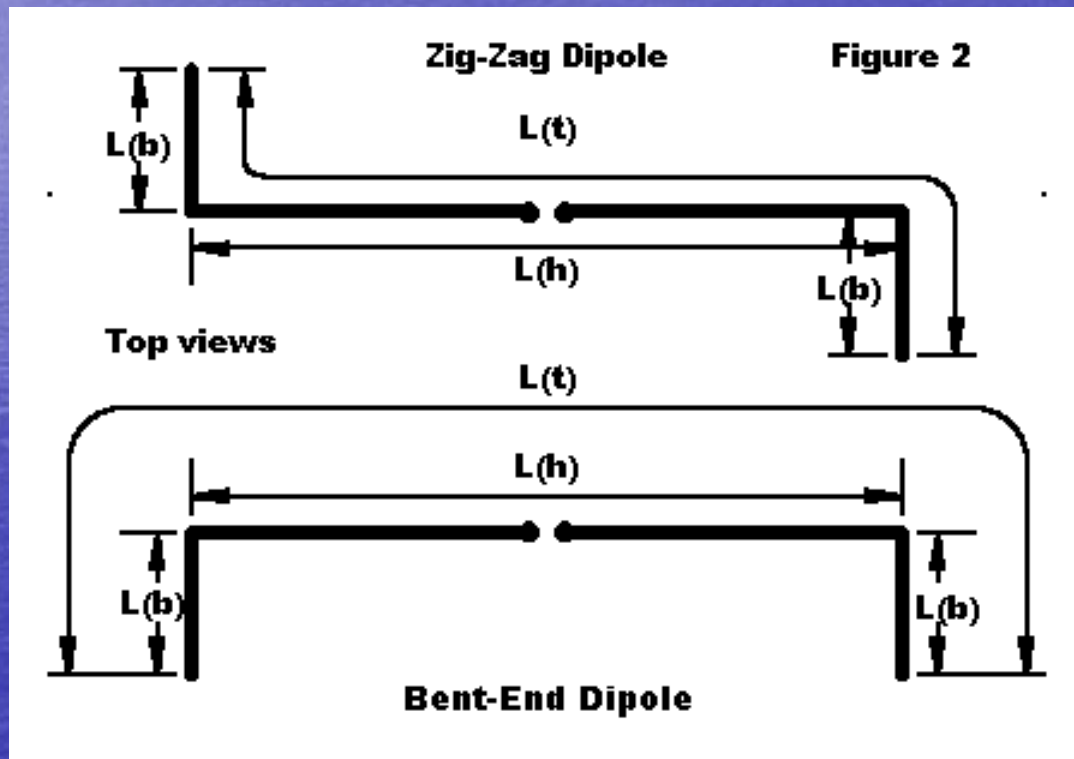
# QRP Antennas

**Figure 1 Full Length Dipole**



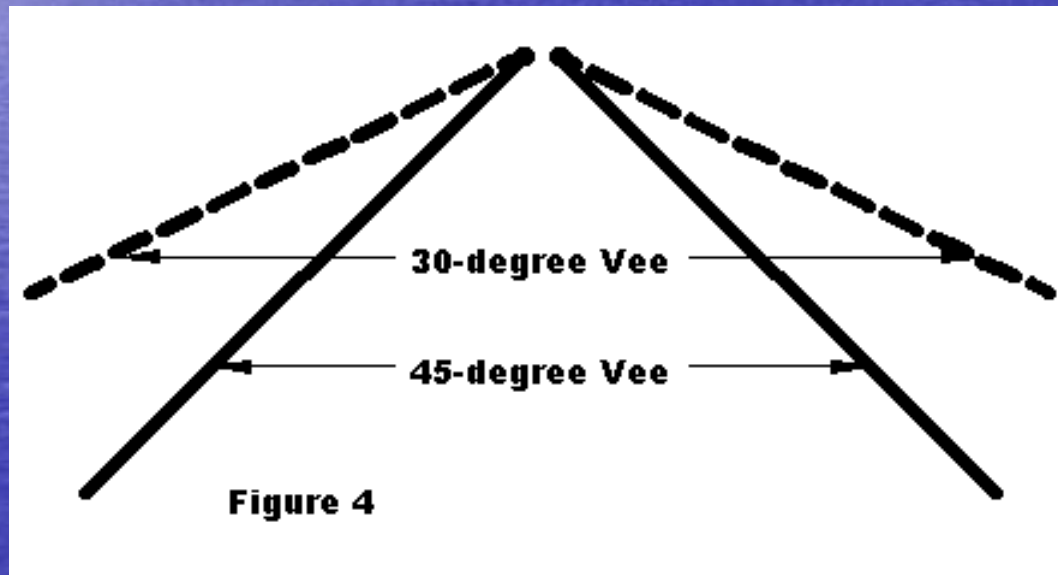
**Bent-End Dipole**

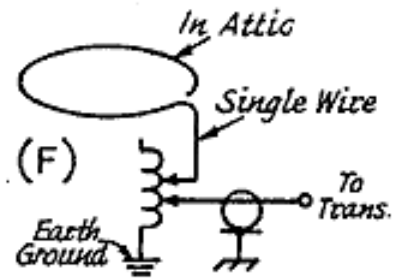
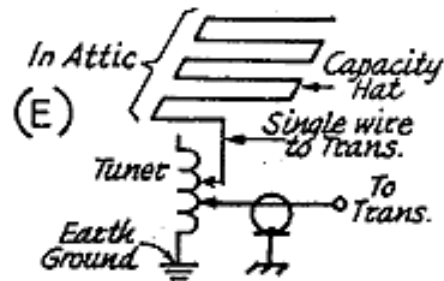
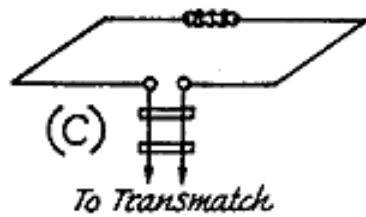
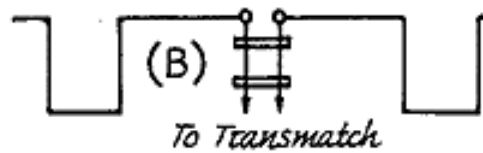
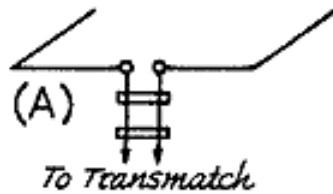
# QRP Antennas



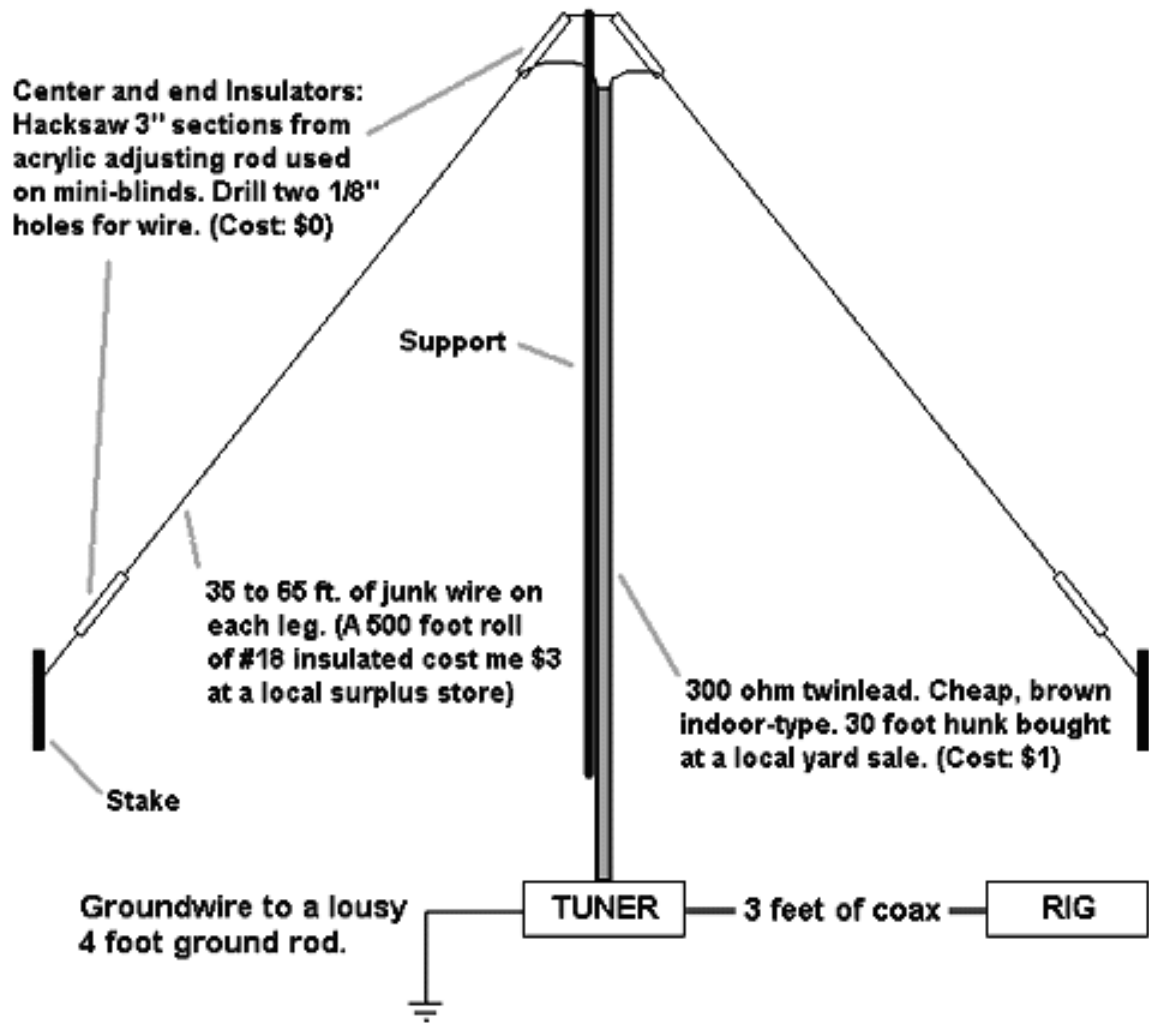


# QRP Antennas

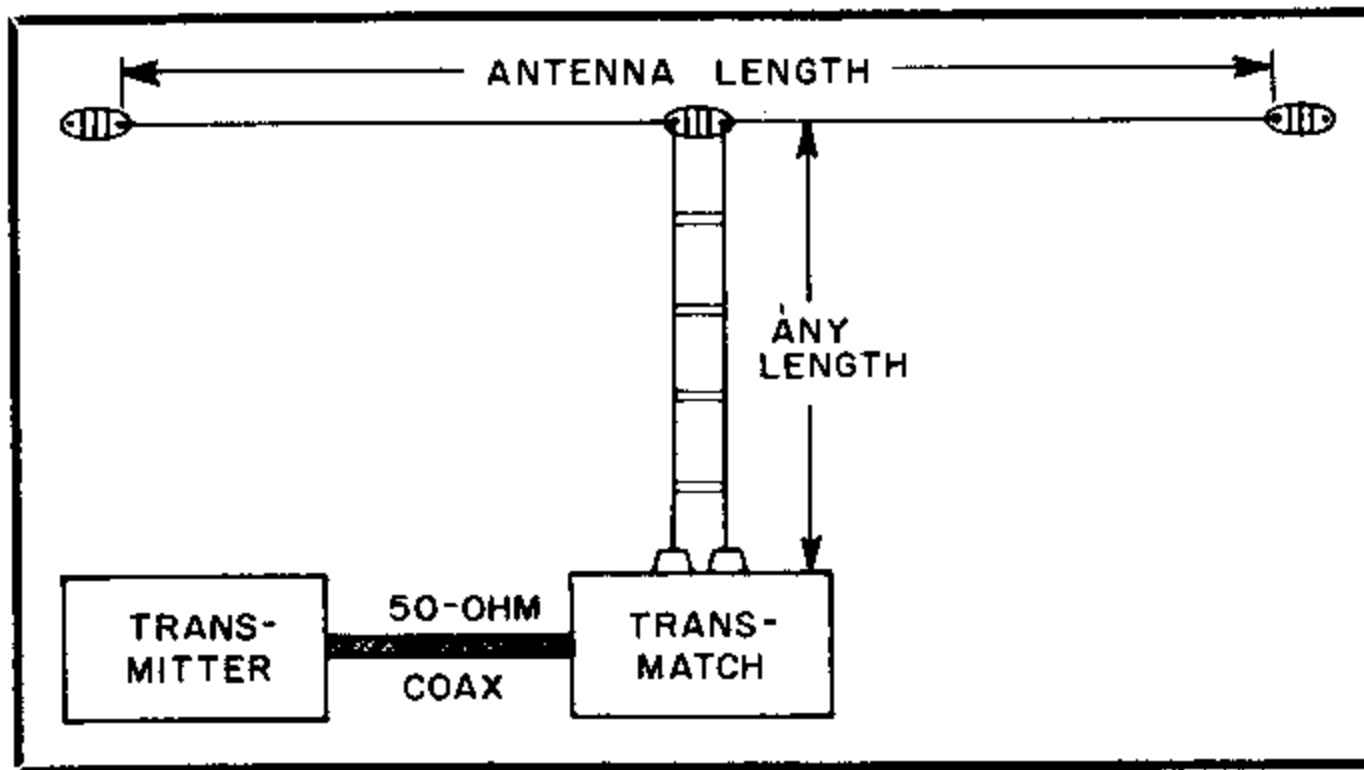








This has been around for decades





# Another popular antenna

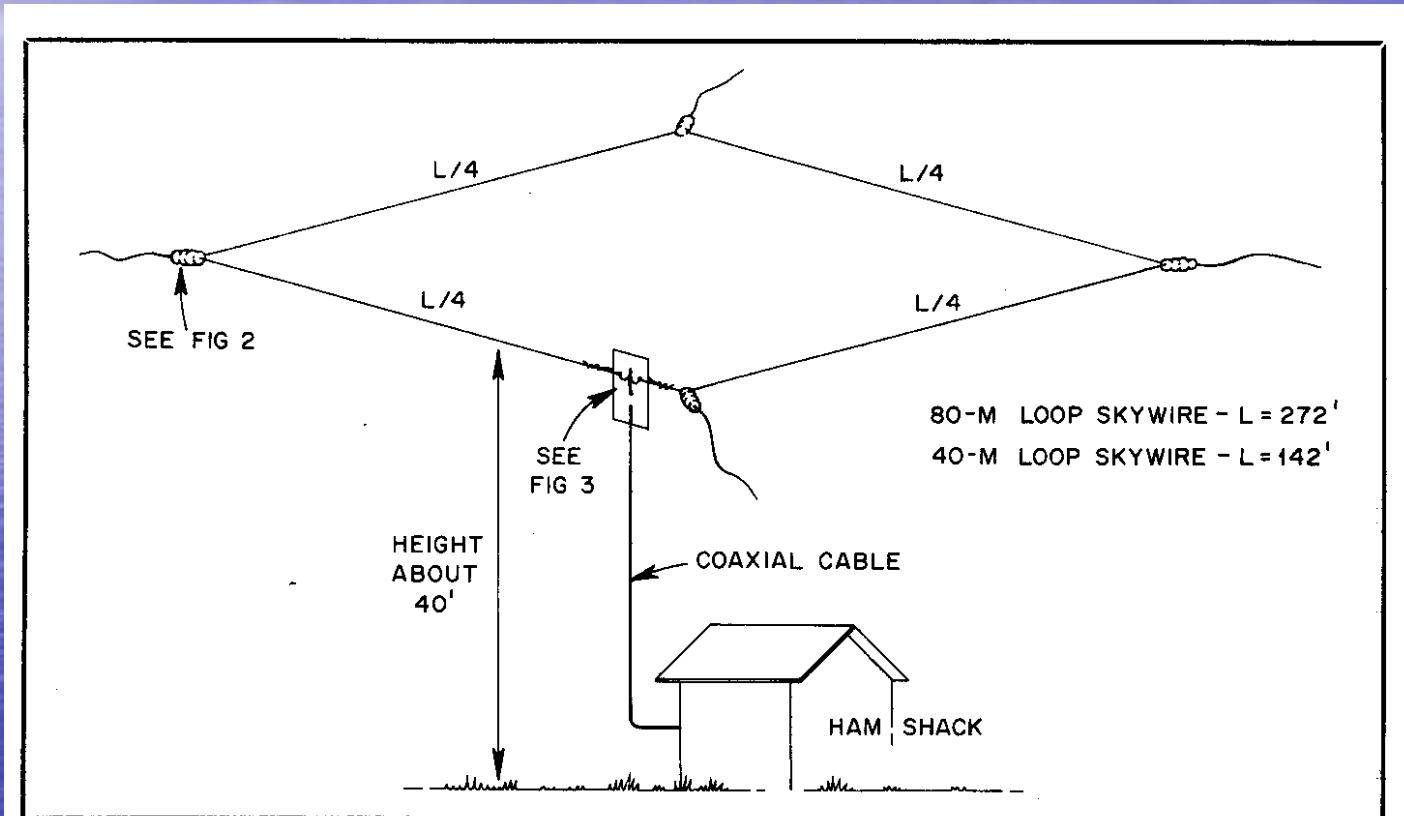
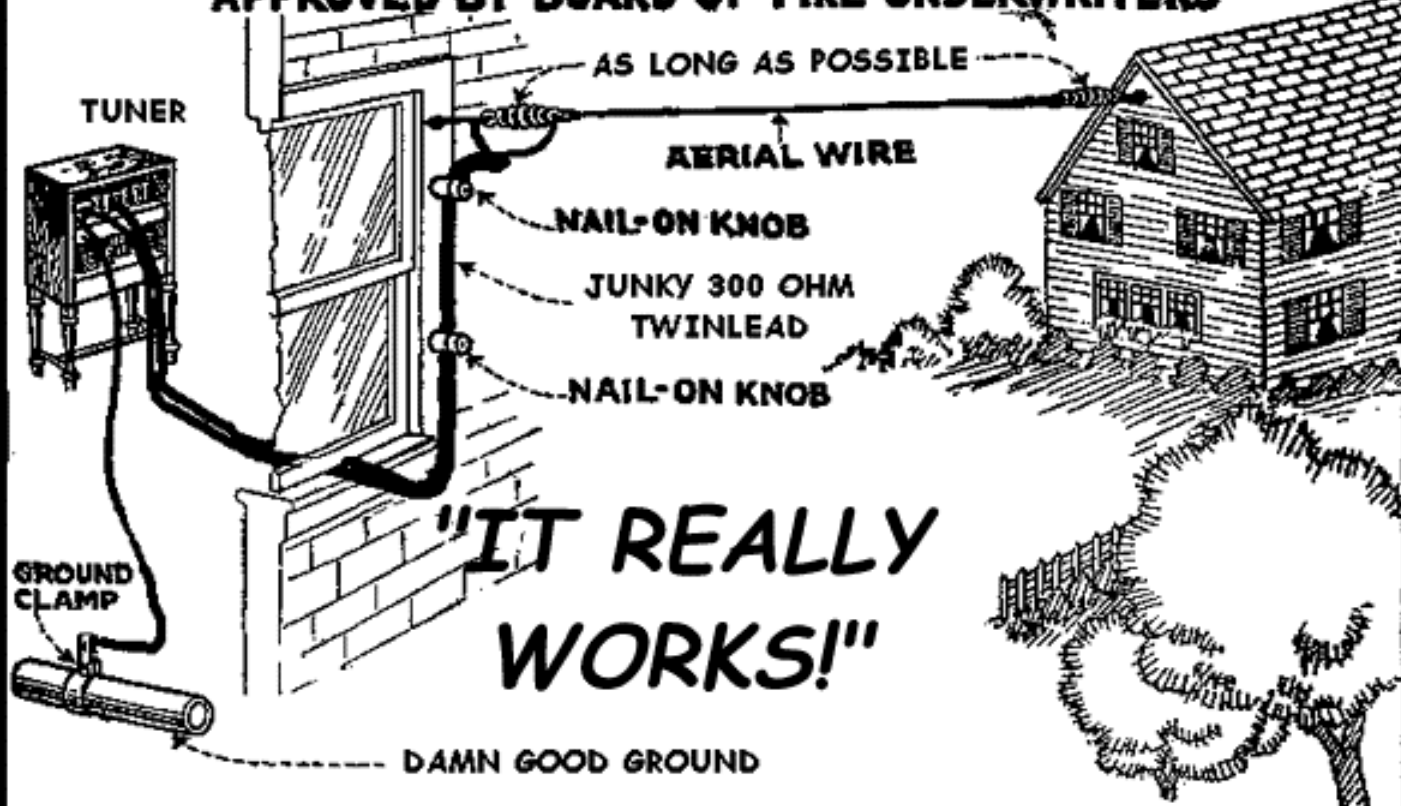


Fig. 1—A complete view of the Loop Skywire. The Loop is erected horizontal to the earth.

# Ye Olde **WB1GFH** **FOUR-DOLLAR SPECIAL**

**APPROVED BY BOARD OF FIRE UNDERWRITERS**





*The other question deals with feedline lengths. Is there any 'ideal' length? Yes and no. Some feedline lengths will present an extremely high impedance to the tuner on certain bands. Each installation is different, but here are some rough guidelines that may help:*

Start by trying a feedline listed in the lengths below. It may take some trimming or adding of feedline to work well on the range of bands you want to cover. The worst possible feedline lengths are shown in brackets:

If Ant is 120 ft per leg it will cover 160 thru 10 meters.

Feedline of 40-70 or 150- 190 feet suggested. [Avoid lines around 120 or 240 ft]

If Ant is 65 ft per leg it will cover 80 thru 10 meters.

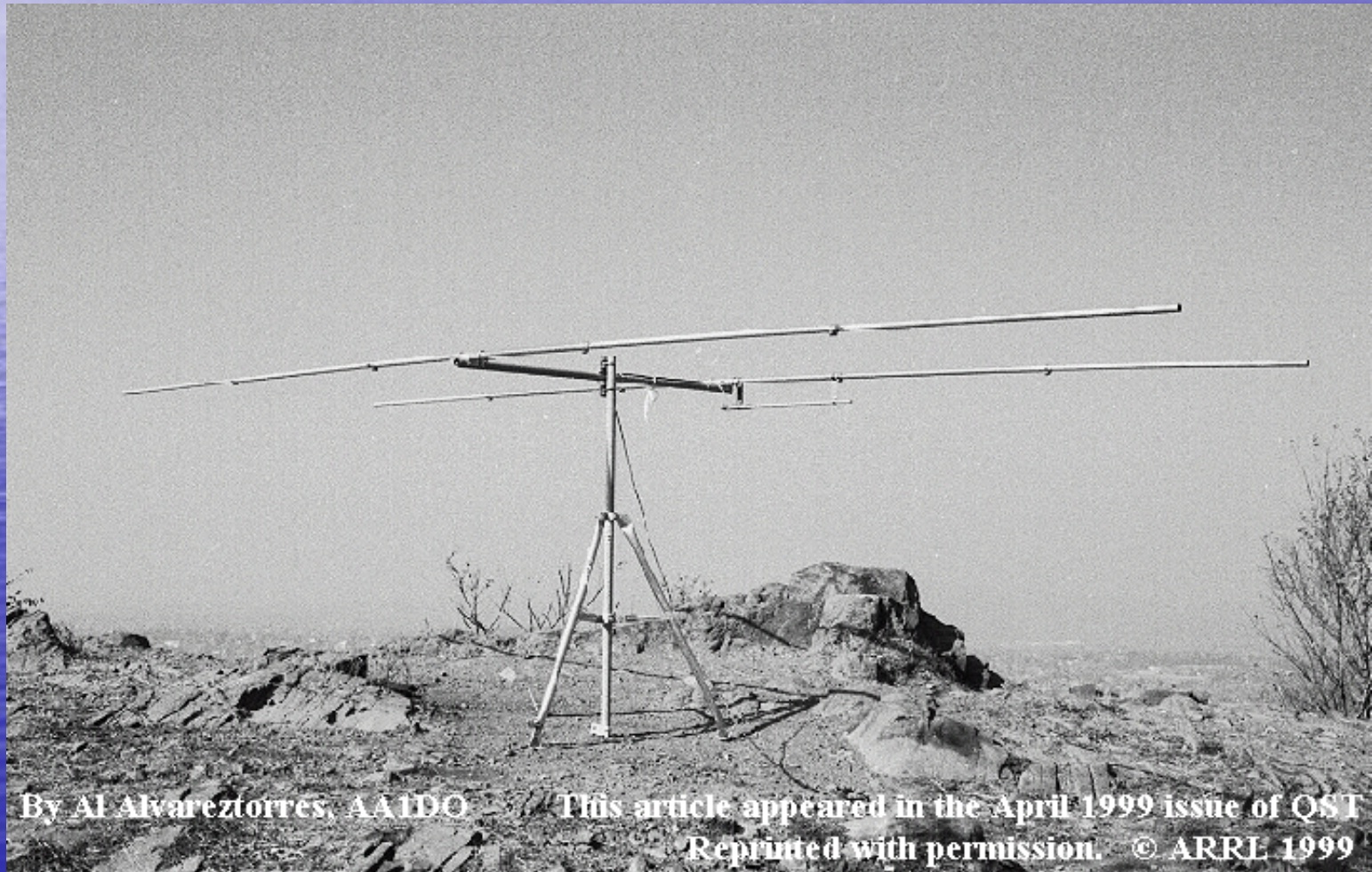
Feedline of 25-40, 80-100 or 140-160 feet suggested. [Avoid lines around 60, 120, or 180 ft]

If Ant is 33 ft per leg it will cover 40 thru 10 meters.

Feedline of 40-50, 70-80, 100-110 or 130-140 feet suggested. [Avoid 30, 60, 90, 120 ft]



# 2-el 10-m Beam



By Al Alvareztorres, AA1DO

This article appeared in the April 1999 issue of QST

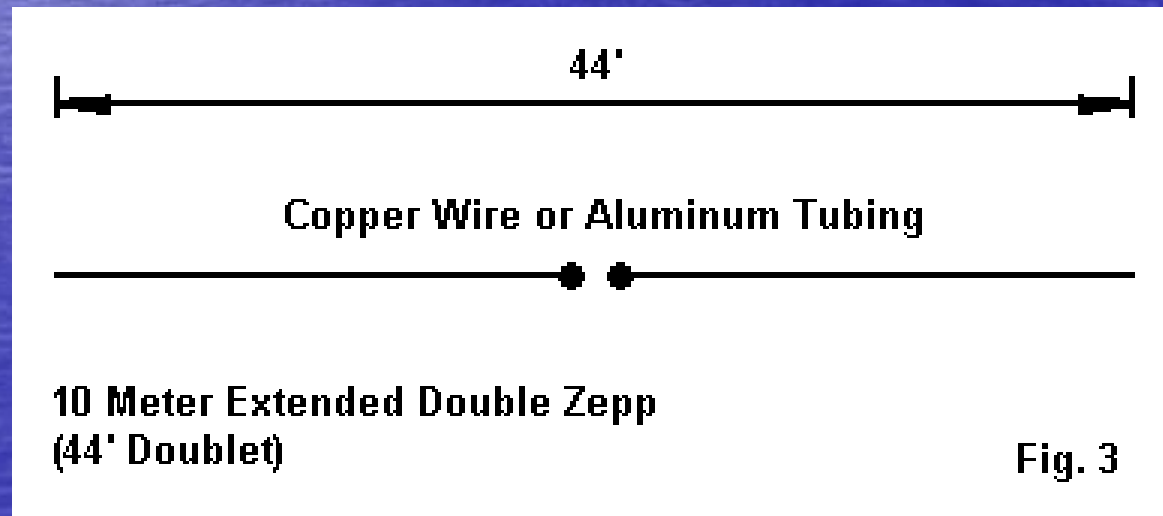
Reprinted with permission. © ARRL 1999



# W4RNL – 44' Antenna

People use with a balanced tuner from 40m to 10m.

I now think that it is on the short side for 40m.



Azimuth Patterns  
44' Doublet  
66' High

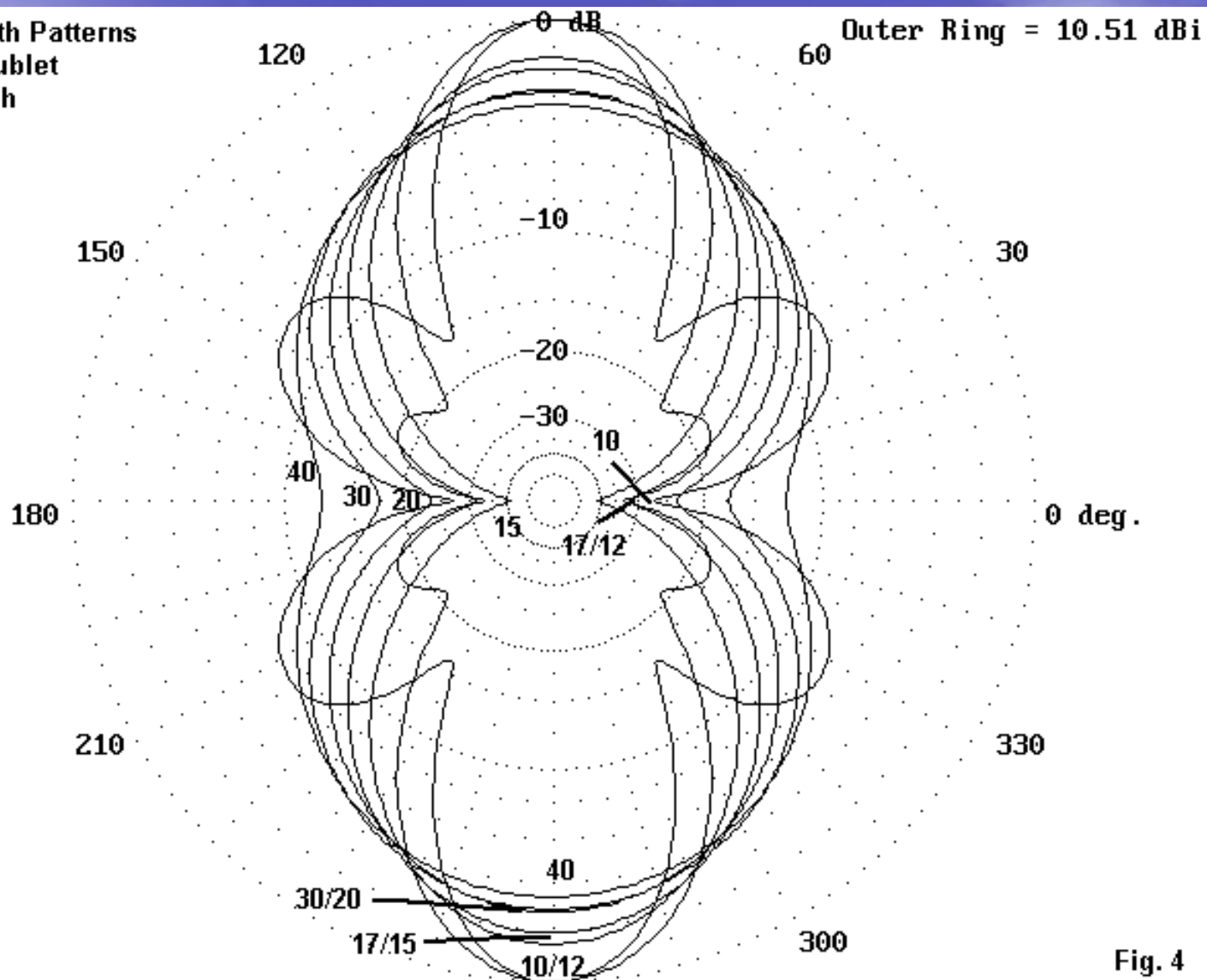
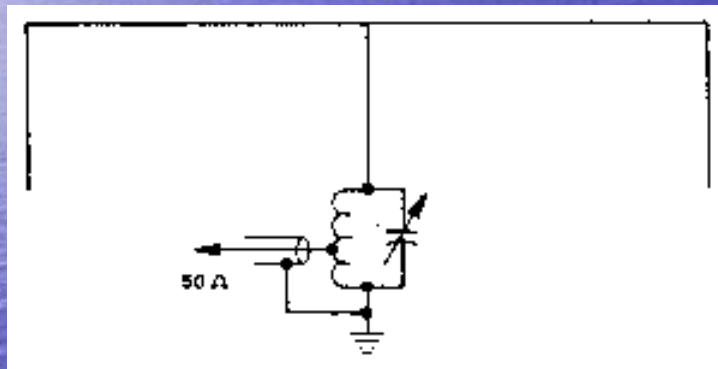


Fig. 4

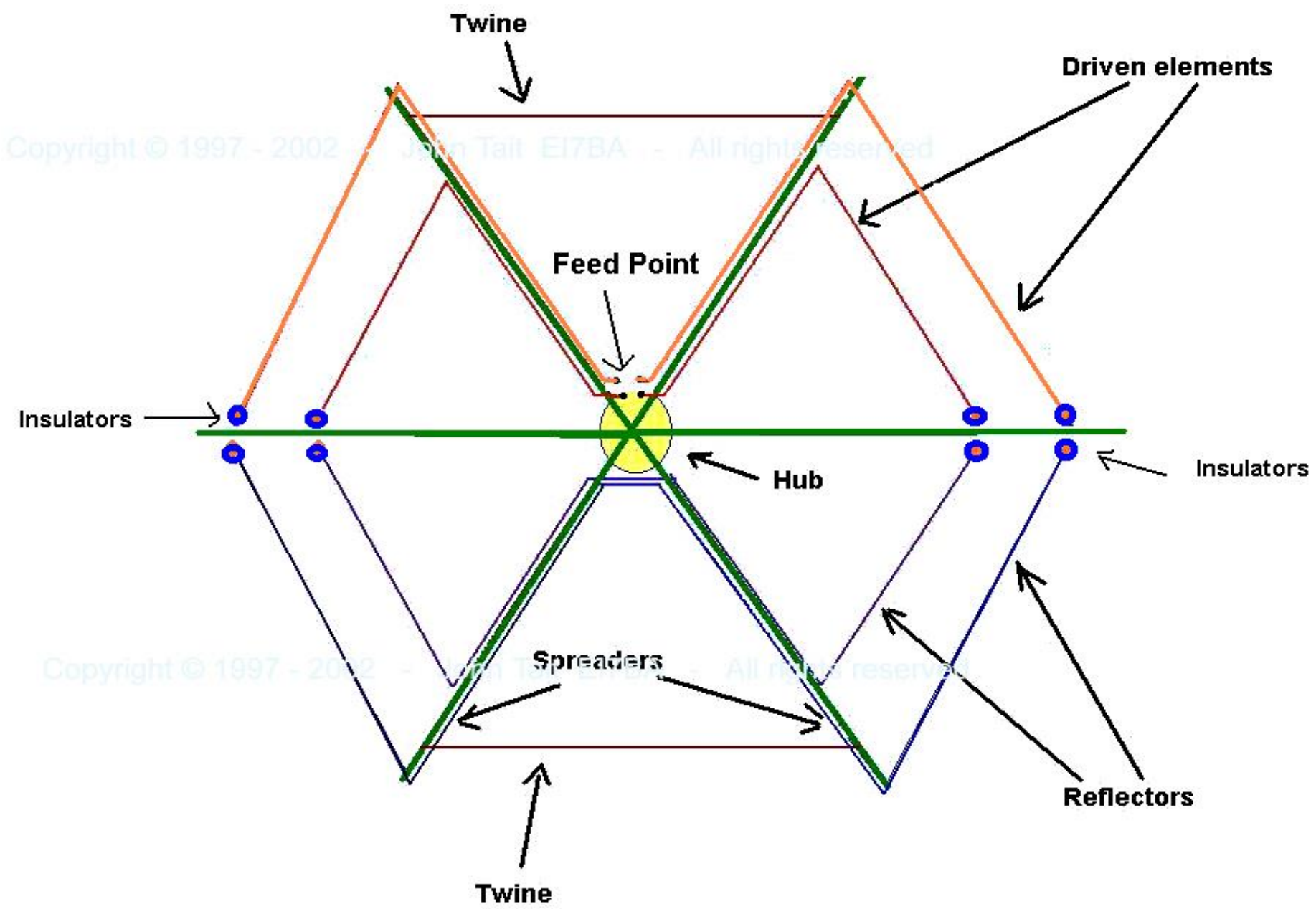


# Half Square



<http://www.angelfire.com/md/k3ky/page38.html>

Freq. MHz	C pF	L uH
1.85	160	46.3
3.50	80	25.8
3.50	86.9	23.8
3.65	80	23.8
3.80	73.7	23.8
3.80	80	21.9
7.00	40	12.9
10.1	30	8.28
14.0	20	6.46

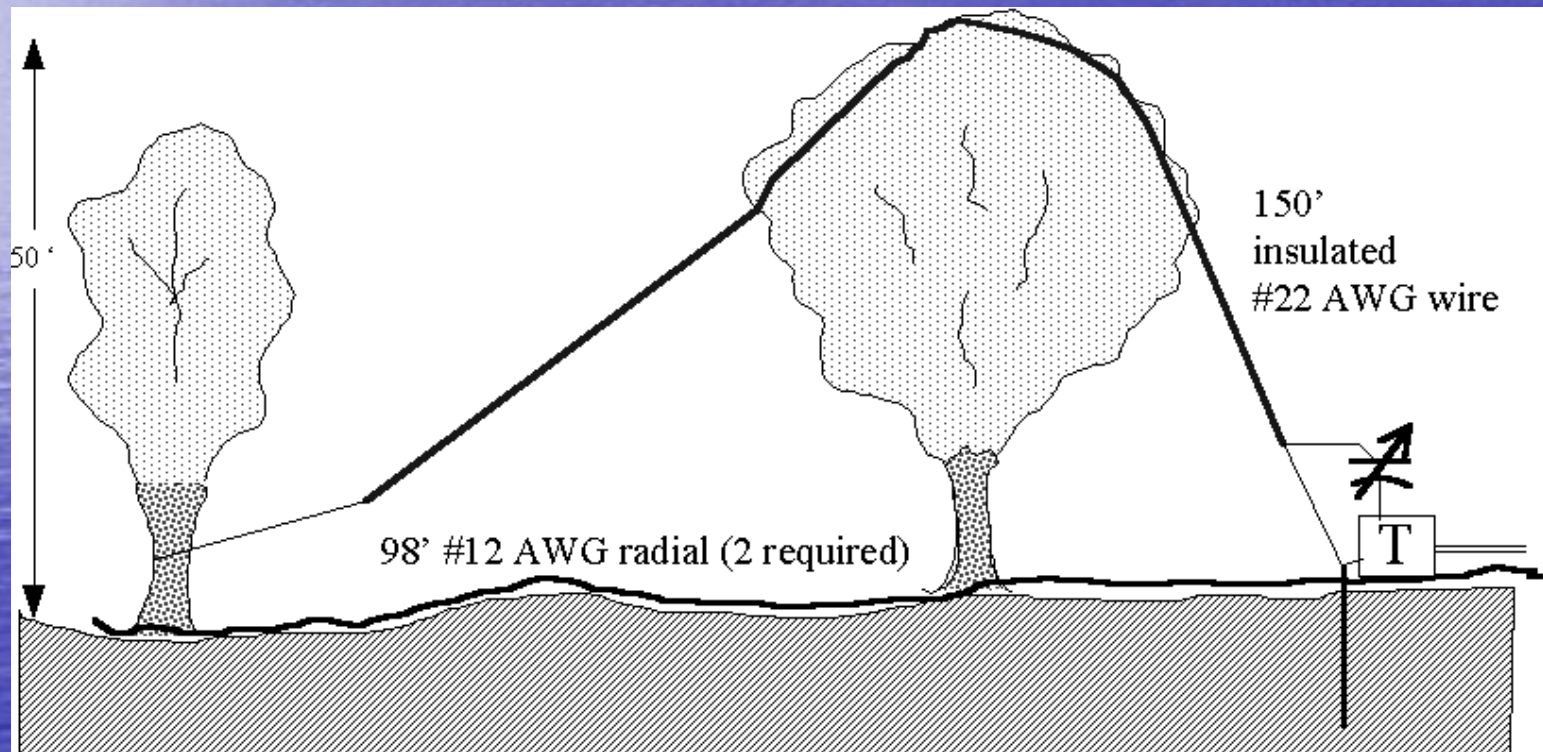




# Hex BEAM

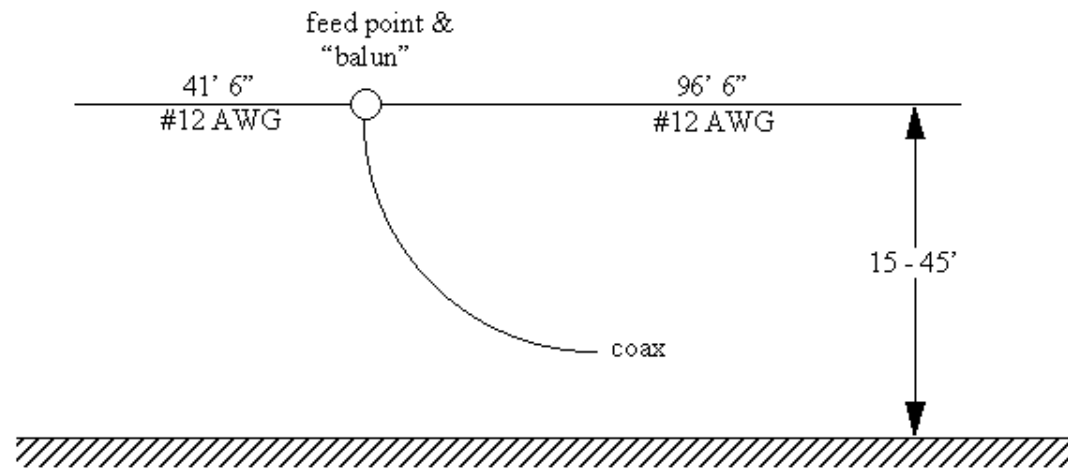
1. The HEX has a very small wingspan, BUT...NO LOADING COILS OR TRAPS!! (Therefore it does not have the losses associated with such devices)
2. It appears to perform much as a full size 2 element yagi, but with a better match to 50 Ohm coax, comparable gain and f/b, but with a bit less bandwidth
3. Physically, it is very light and strong. It can be multibanded by nesting elements one inside the other, like a multi-band Quad.
4. As it is hexagonal in shape, it has no "bias" in windy conditions, so a very small rotator is sufficient.
5. <http://ireland.iol.ie/~bravo/ahexbeam.htm>

# 160-m Inverted "U" (K3MT)





# 6-Band Windom (K3MT)



Off-center fed Windom  
mounted horizontally

K3MT  
(c) 1997  
M. Tolia

# Magnetic Loop (W4OP - PAR)

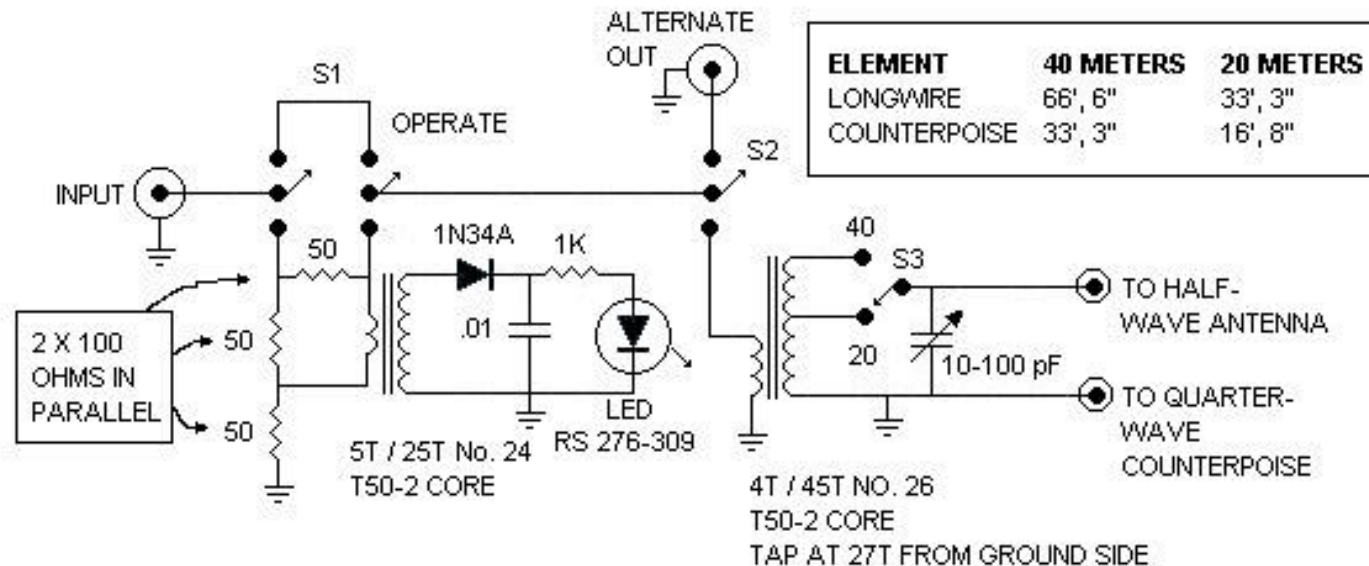




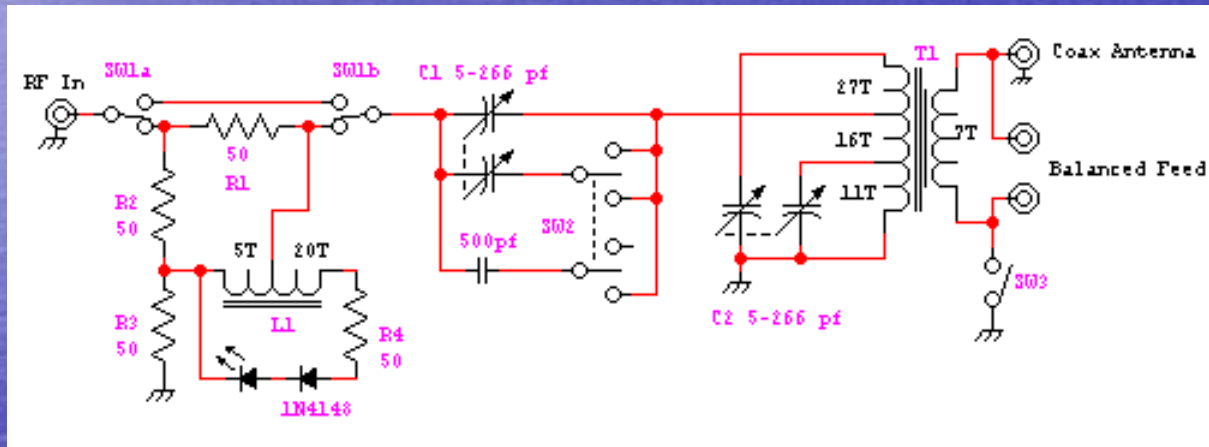
# 2-Band Half-Wave Wire Tuner

## A TRAIL-FRIENDLY END-FED ANTENNA TUNING UNIT

*TWO-BANDER WITH LED SWR BRIDGE*



# "Z" Match Tuner



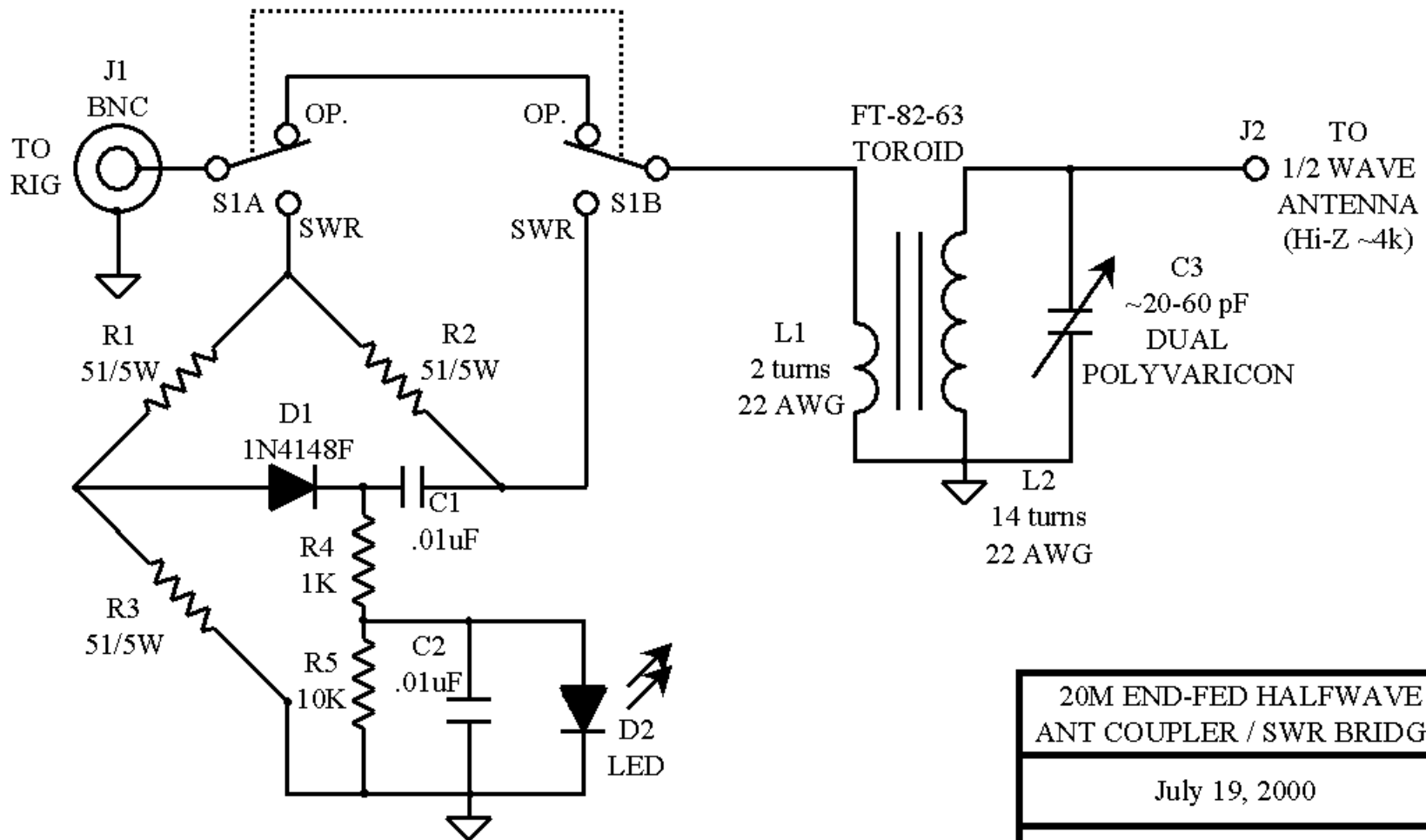


# Welcome to the G3TPW CobWebb web site of Stephen R. Webb



S.R.Webb  
ASTRID House  
The Green  
Swinton  
MALTON  
North Yorkshire  
YO17 6SY  
ENGLAND

Tel: Malton (01653) 697513



20M END-FED HALF WAVE ANT COUPLER / SWR BRIDGE
July 19, 2000
Stephen R. Yates, AA5TB

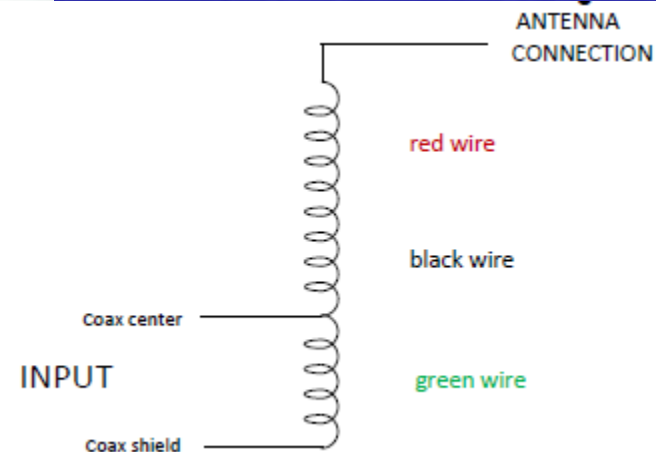


# Another End-Fed Tuner

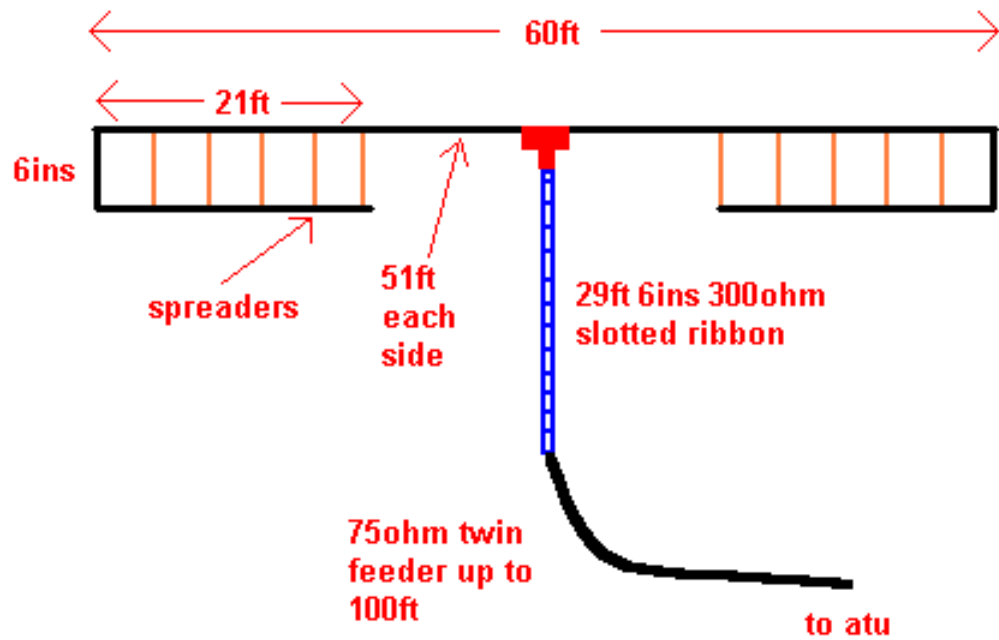
## 9 to 1 Balun



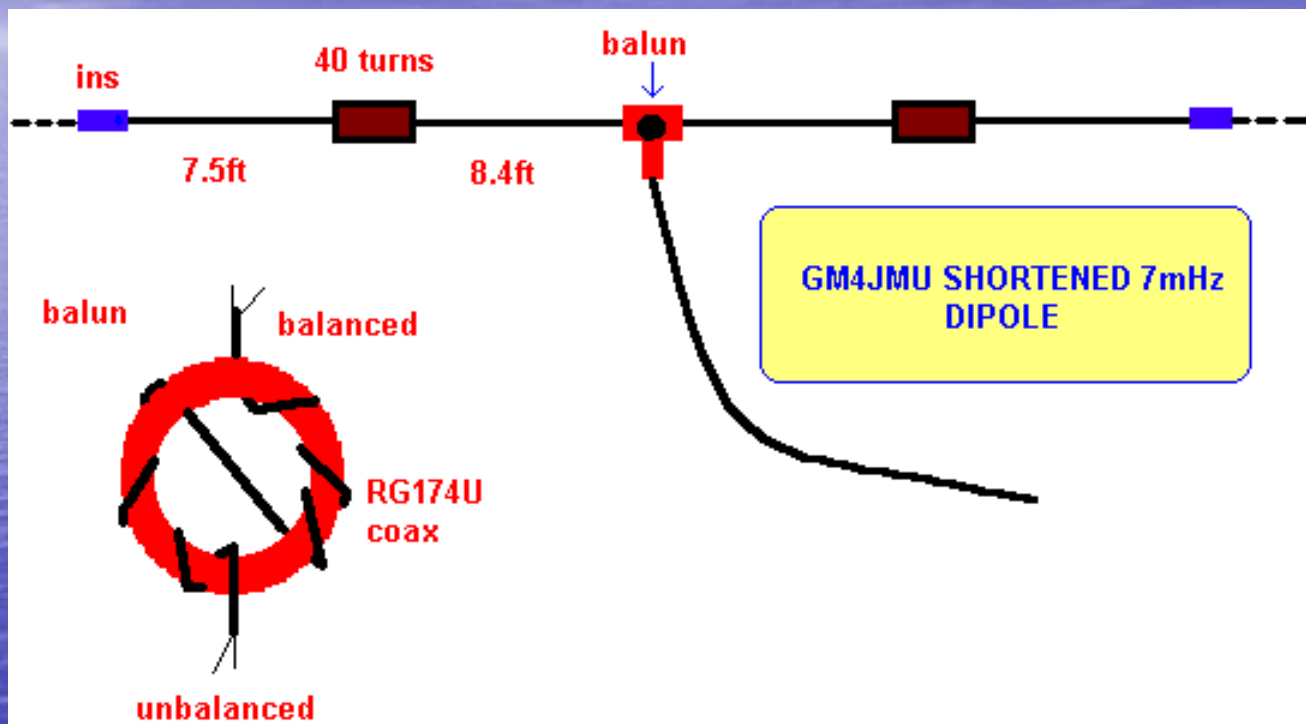
Experience has shown that most external tuners and many internal tuners will tune 80–6 meters with an antenna length of 22' to 30'. If a longer antenna is desired, the provided antenna can easily be lengthened.

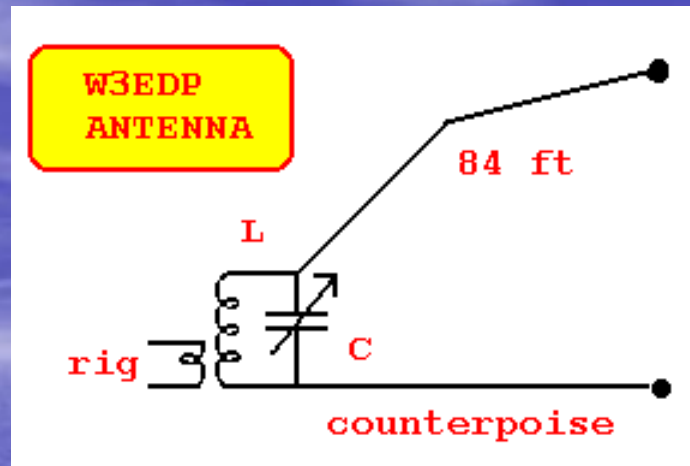


**A SMALL GARDEN  
ANTENNA  
G4KIH**









The Tuning capacitor in the AMU can be a 365 - 500pF broadcast type or a miniature version is OK for QRP use.

### Counterpoise lengths

- 3.5 & 7.0Mhz - 17ft
- 14Mhz - 6.5ft
- 28Mhz - none

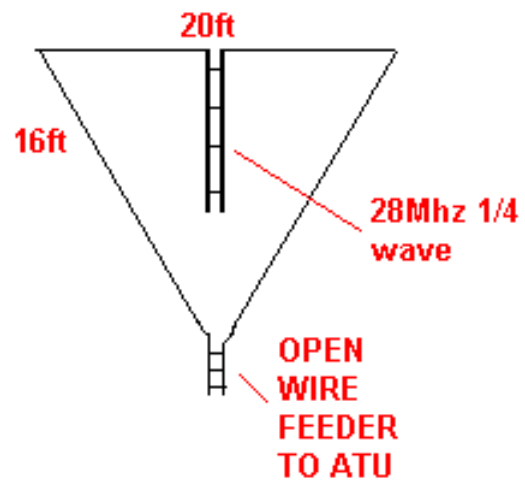
### Tuning Unit

Values for coils in the unit, based on a 2 inch former and 16 swg wire:

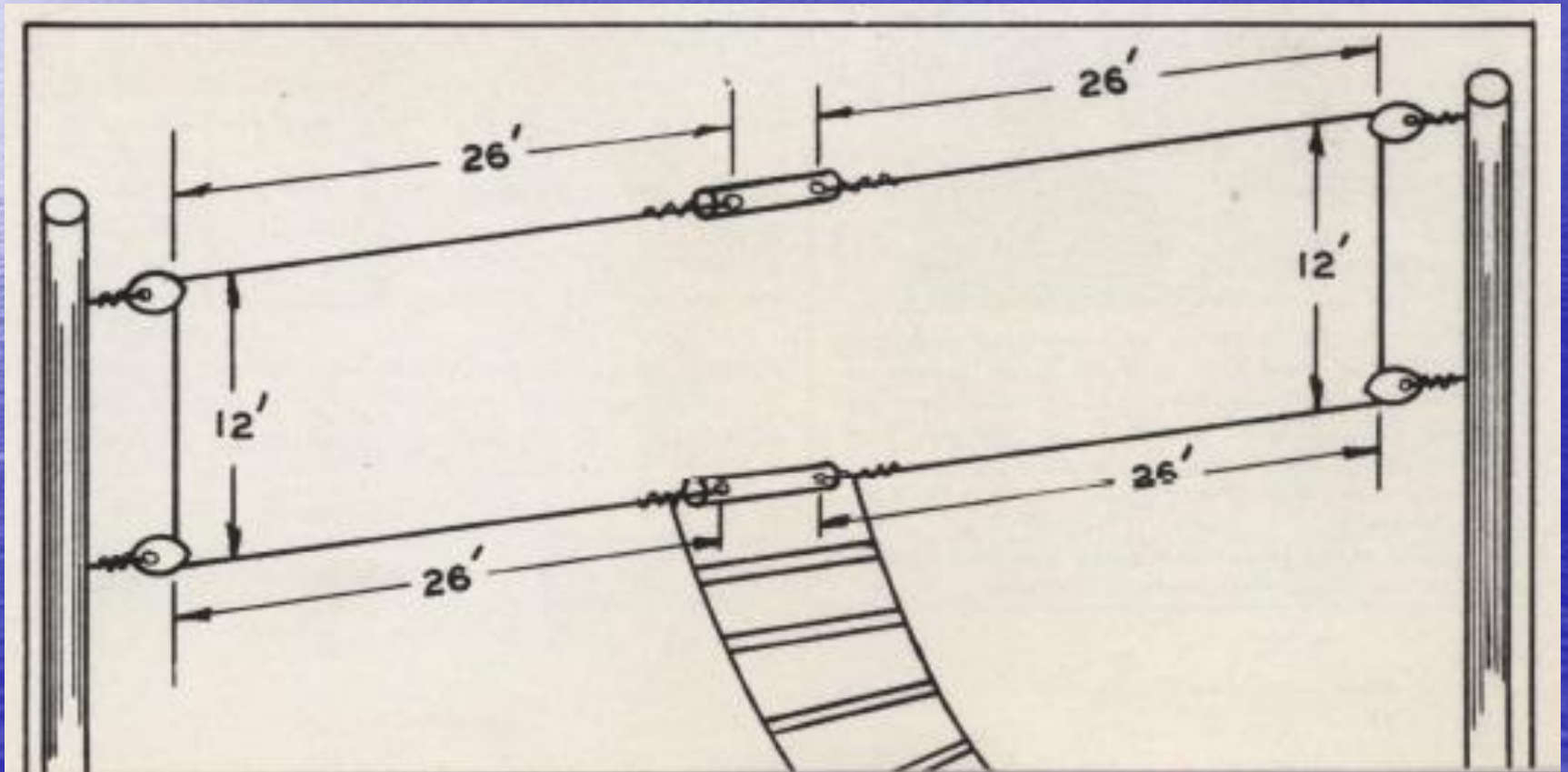
- 3.5Mhz 21 turns
- 7.0Mhz 7 turns
- 14.0Mhz - 5 turns.



## DL2HCB MULTIBANDER



# All-Band Antenna 80 to 10 RCA Ham Tips Nov 1952 Double the lengths for 160m!





# 80m Beam – Dream on!



My First QRP Rig was the Heathkit HW8.  
Better than the HW7 and HW9 but Direct  
Conversion means you hear signals on both sides  
of zero beat.





Upper left = NorCal NC-40A

Lower left = Ten Tec Argosy – 5 or 50 watts







Lower left = Elecraft KX1, one of my all time favorite QRP rigs.





I sold the Argosy to buy the Elecraft K2, the best QRP rig ever made.





I sold the KX1 to help fund the purchase of the K3.





# This guy can't be married!

## A mobile station for QRP





# My Recommendations and Things You Can Build

W2XS

# Rig (kit)

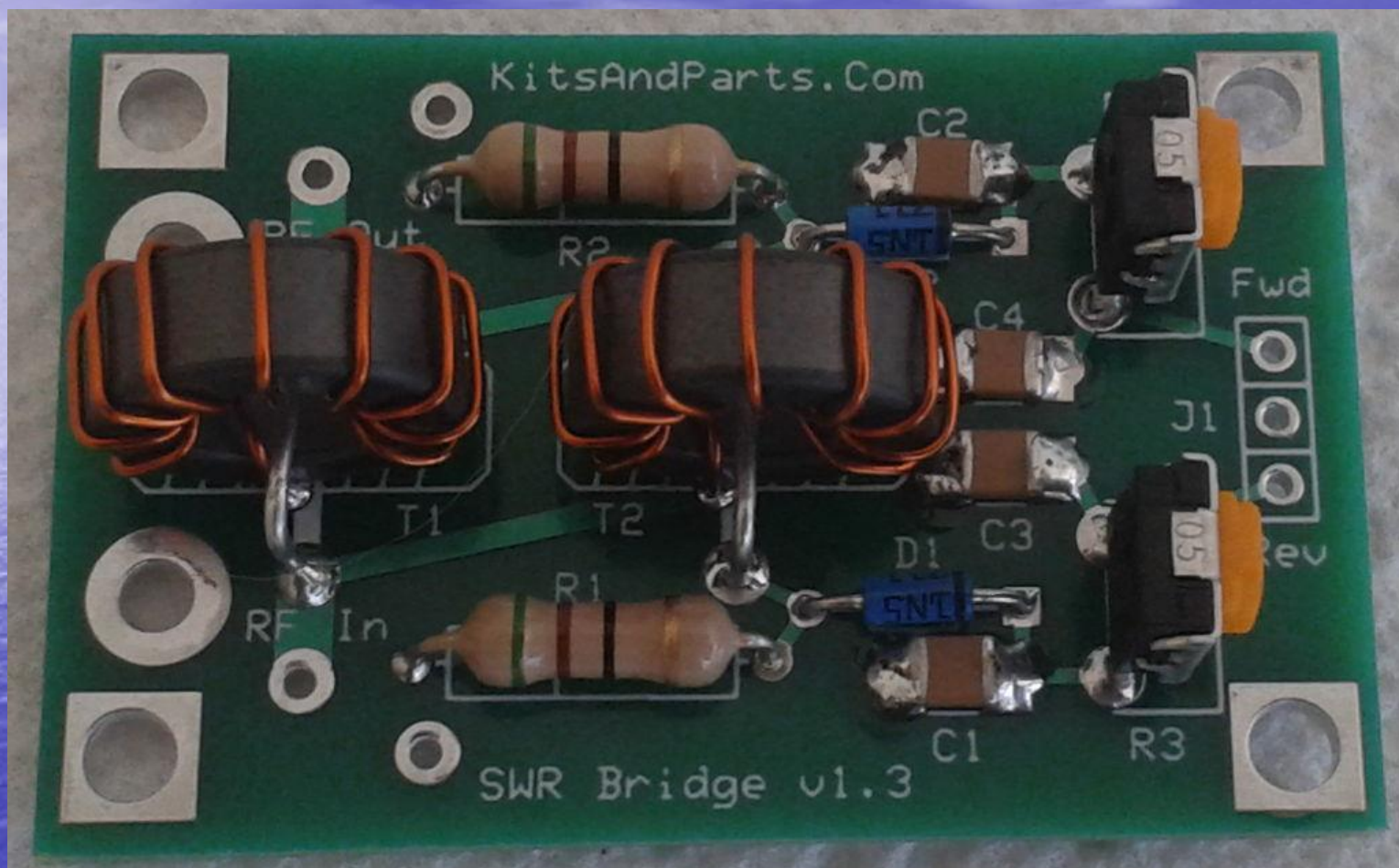
- LNR MTR 3 or 5
- QRP Kits PFR3 (\$250) 5 W+
- OHR 100A (\$150) 5 W+
- Elecraft K1 (\$300 to \$400+) 6 W+
- Elecraft KX1 (\$300 to \$400+) 3 W
- Elecraft K2 (\$600+) 10 W+
- Elecraft KX2 or KX3 (10 W or 15 W)
  - Look at eBay or eHam.net
  - Good QRP link:  
<http://www.amqrp.org/misc/links.html>



# Things you can build

- Antennas
- Antenna Tuners
- Power meters
- Dummy Loads
- VSWR meters
- Receivers
- Transmitters
- Audio filters (passive and active)
- Speaker systems

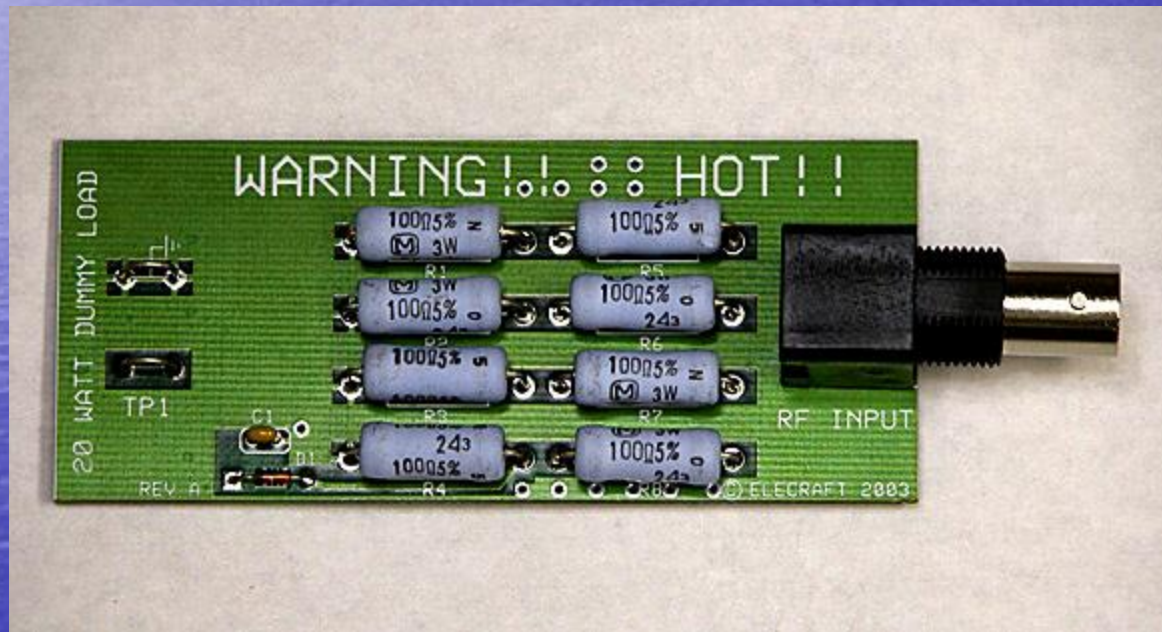
# SWR kit for \$8





# Dummy Load kit for \$26

## Can measure power with a voltmeter





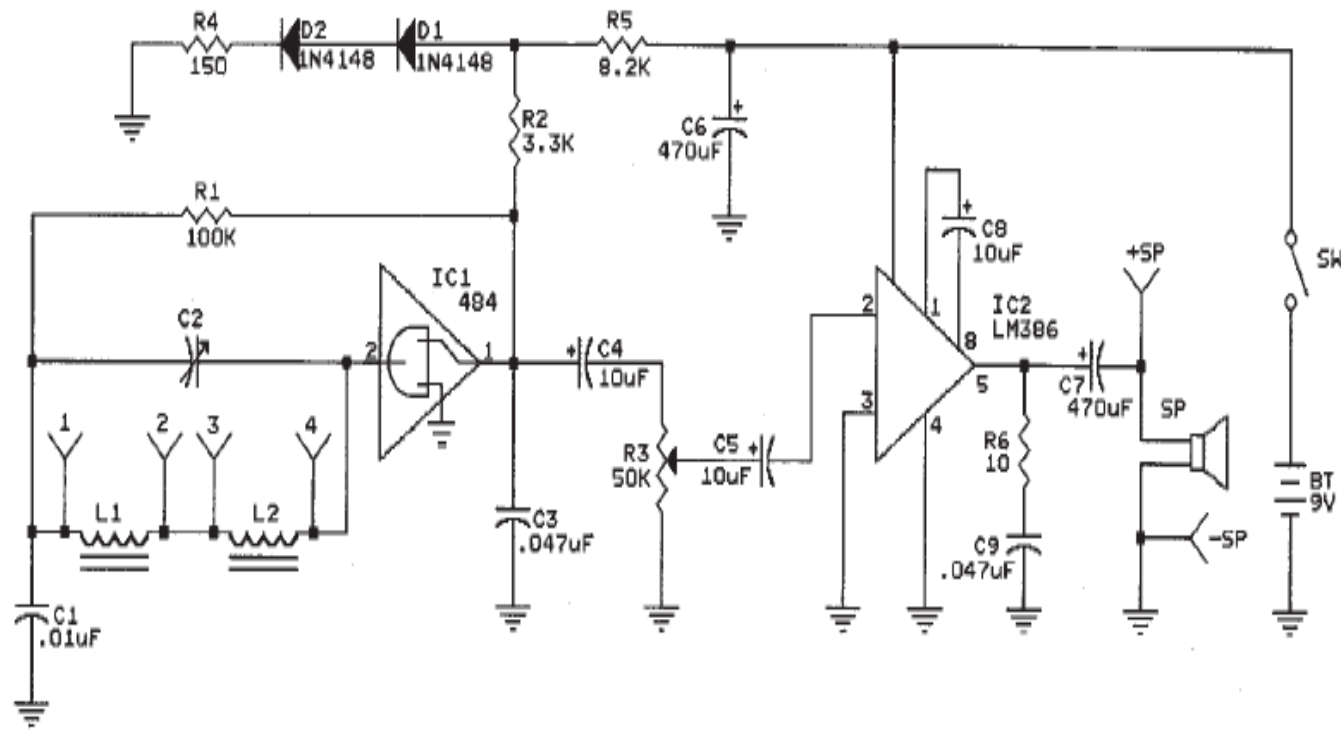


# A simple regenerative receiver Similar to this one [www.4sgrp.com](http://www.4sgrp.com)



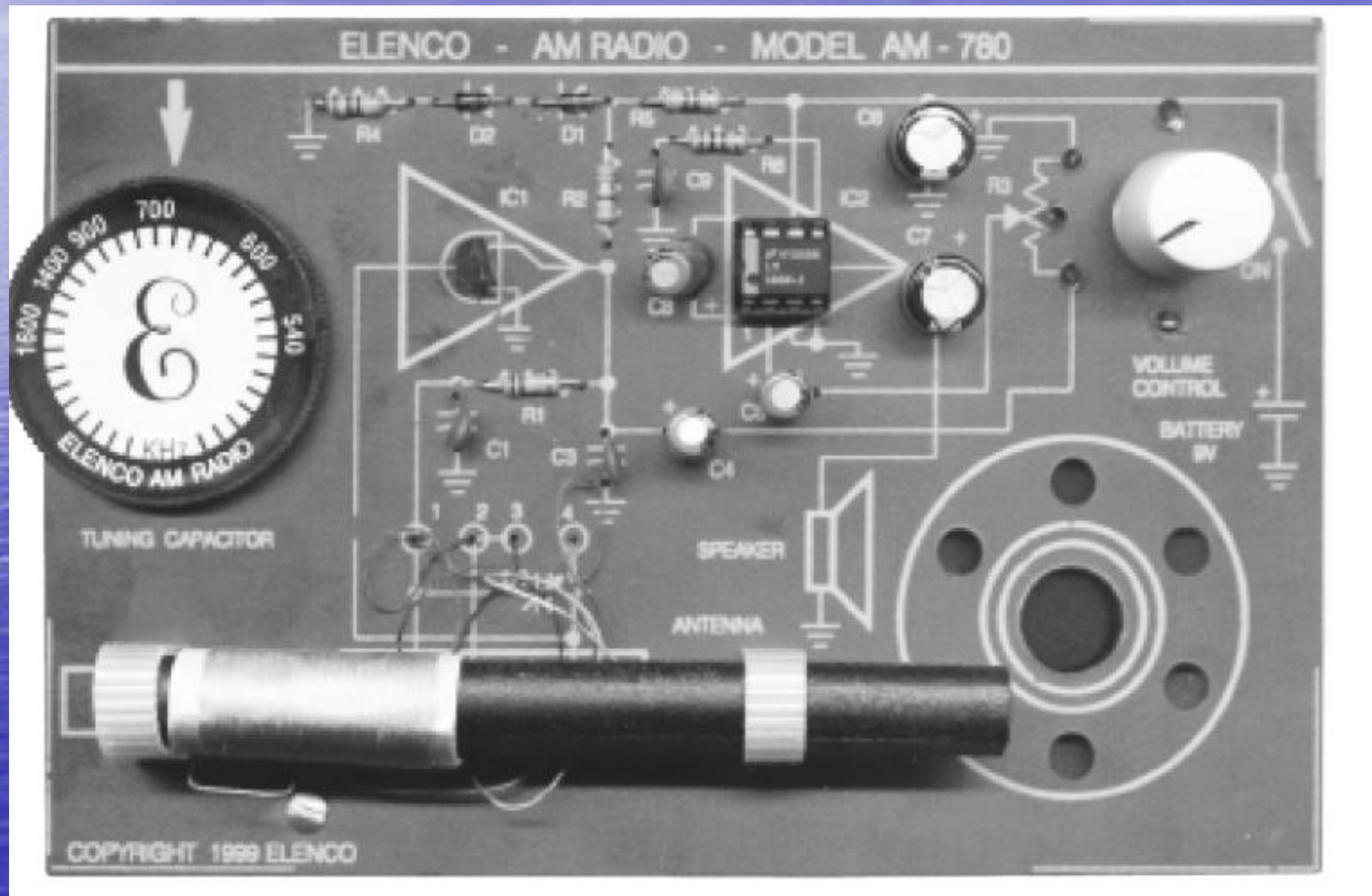
# A simple TRF AM Radio - MK484

## SCHEMATIC DIAGRAM AM-780K

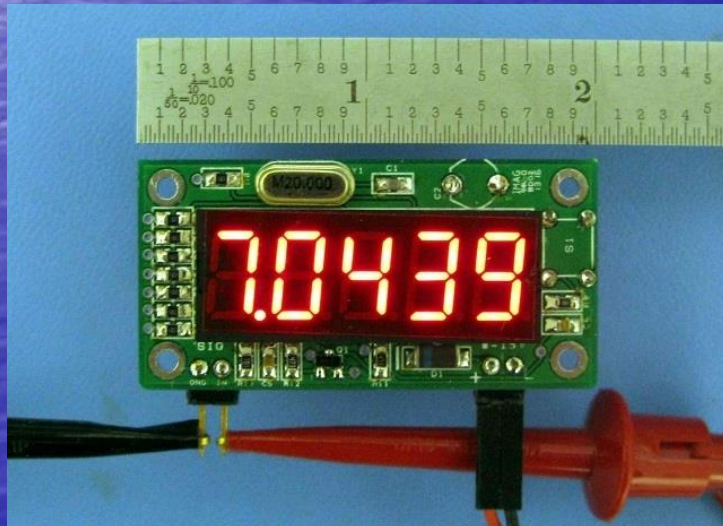




# A simple TRF AM Radio - MK484



# Qrpguys.com sells nice stuff

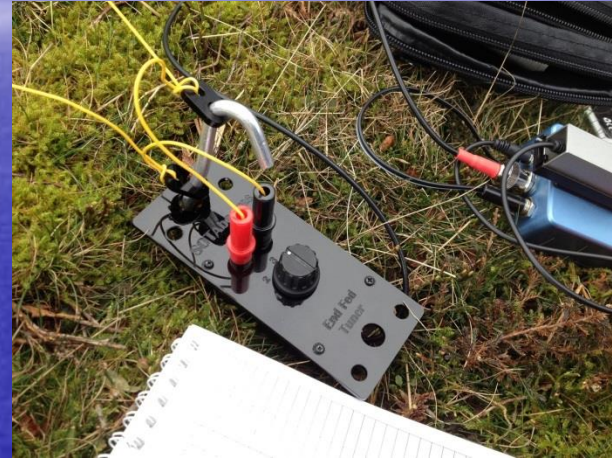
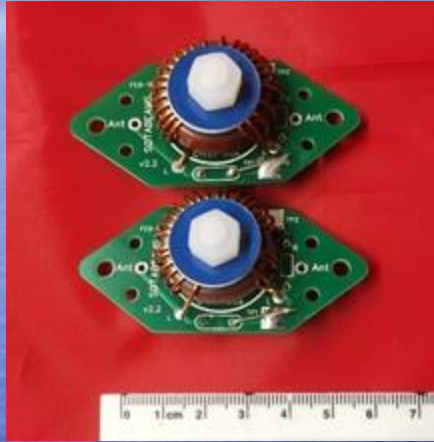




# Qrpkits.com does too



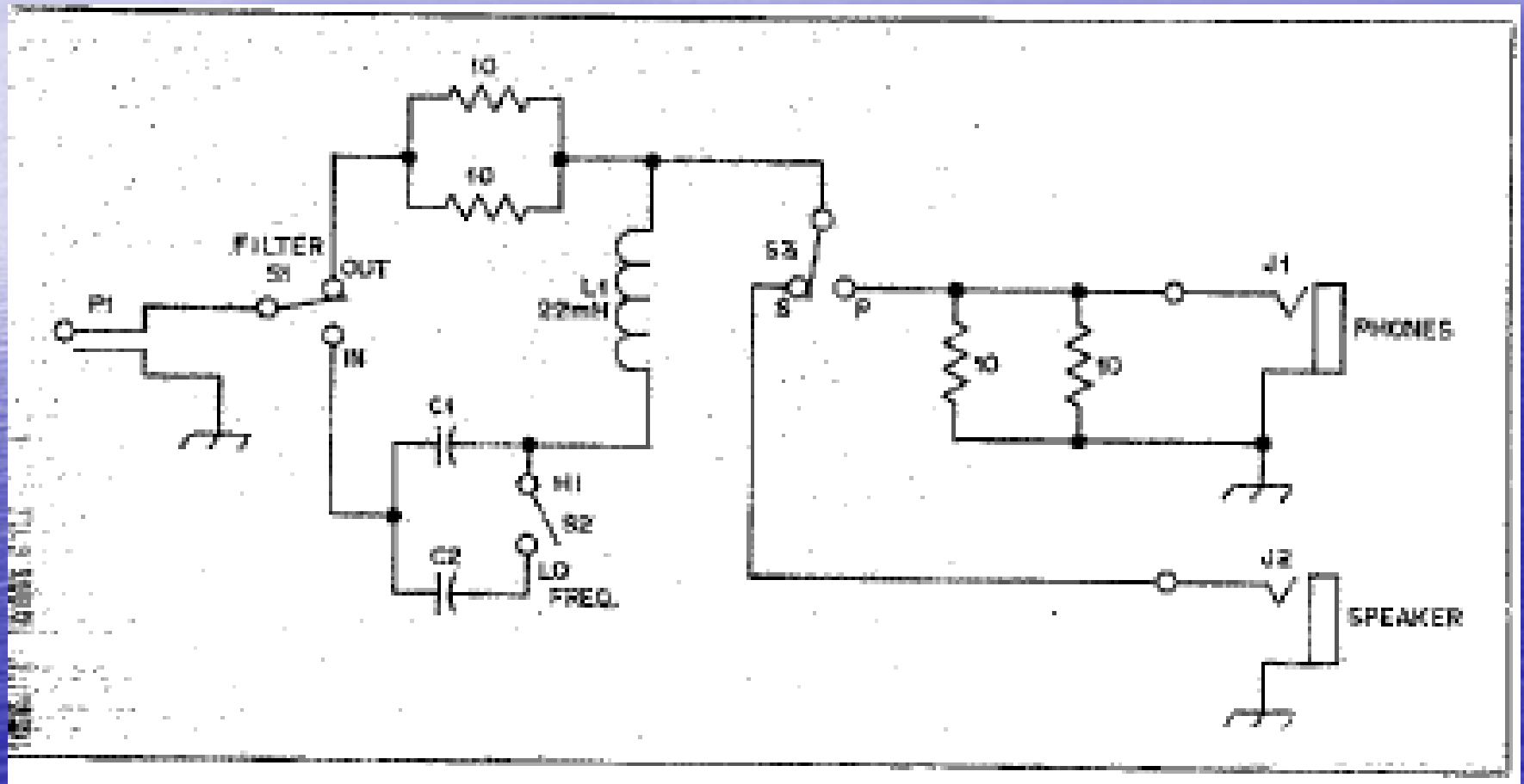
# Sotabeams.co.uk does too



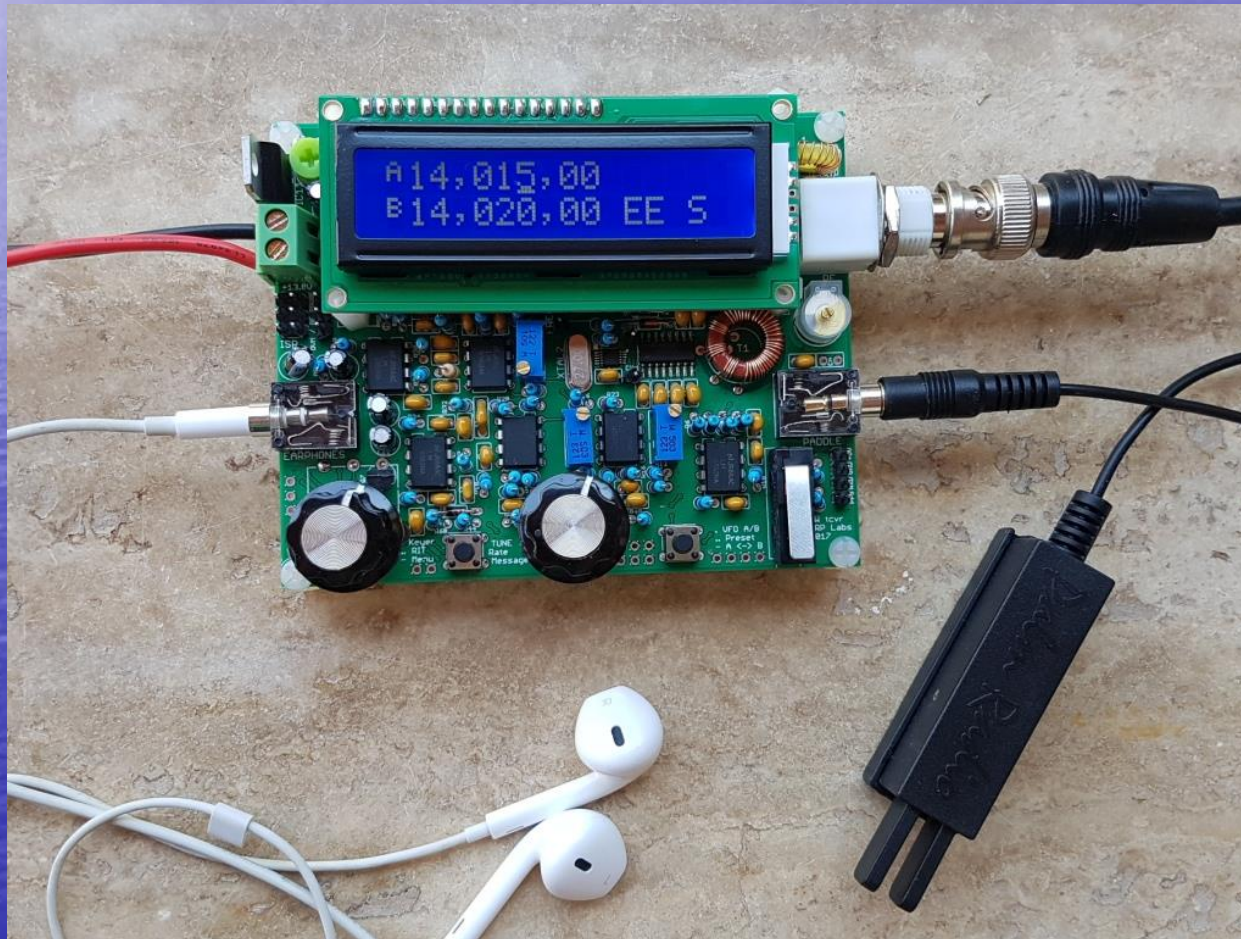


# Passive Audio Filter

## QST November, 1977



# QRP Labs QCX 5W - \$50 kit





# From QRZ.com Yesterday - \$60





From QRZ.com - \$65 for all





From QRZ.com - \$290





From QRZ.com - \$100





From QRZ.com - \$450



From QRZ.com - \$400





From eBay - \$300 - New



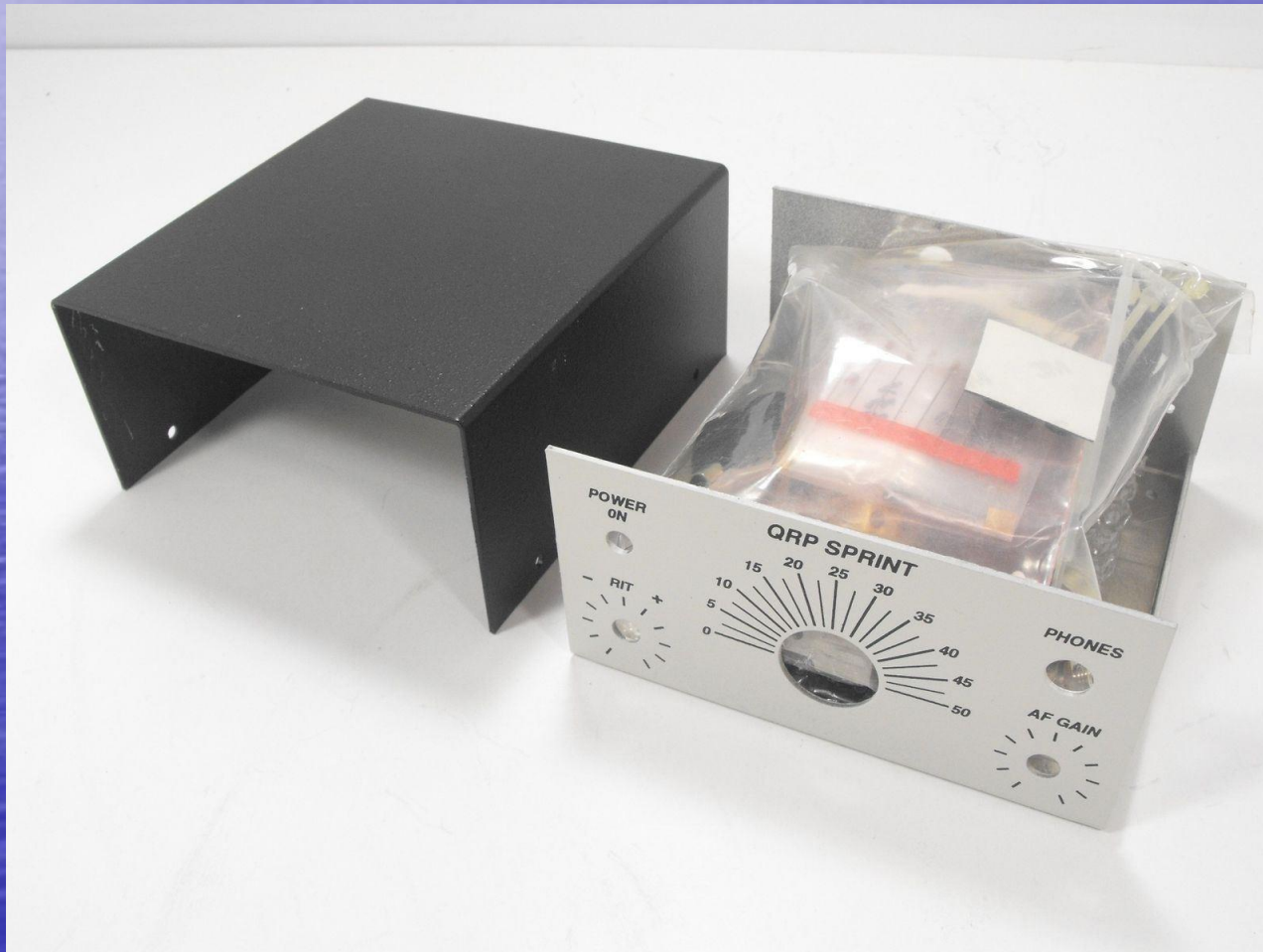


From QRZ.com - \$300



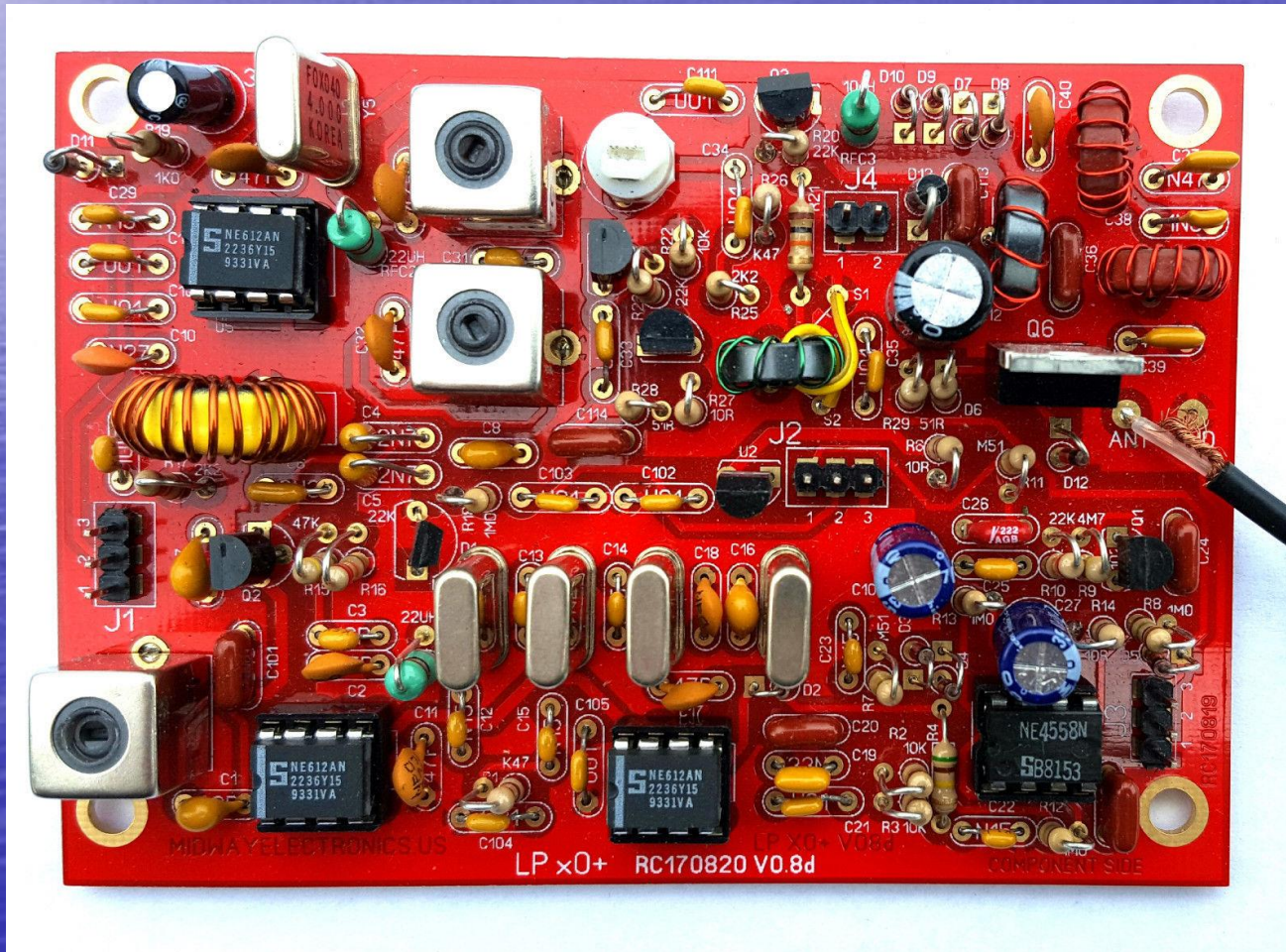


# From eBay - \$136 NOS Kit





# From eBay - \$65 New SWL40+ Kit





From swap.qth.com - \$225



# Elecraft Rigs That I Own

- KX1 (S/N 015)
- KX2 (S/N 1234)
- K1 (S/N 2191)
- K2 (S/N 1116)
- Drake T4X (S/N 11116)
- K3 (S/N 919)
- HexKey (S/N 113)



# Summary

- Don't skimp on the antenna. Let the entire wave get radiated.
- Choose a CW or an SSB rig.
- Have fun. That's what this hobby is all about.



# Keep it simple? K30MI





# Keep it simple? W9EVT (1 of 44)





# Keep it simple? W9EVT (2 of 44)



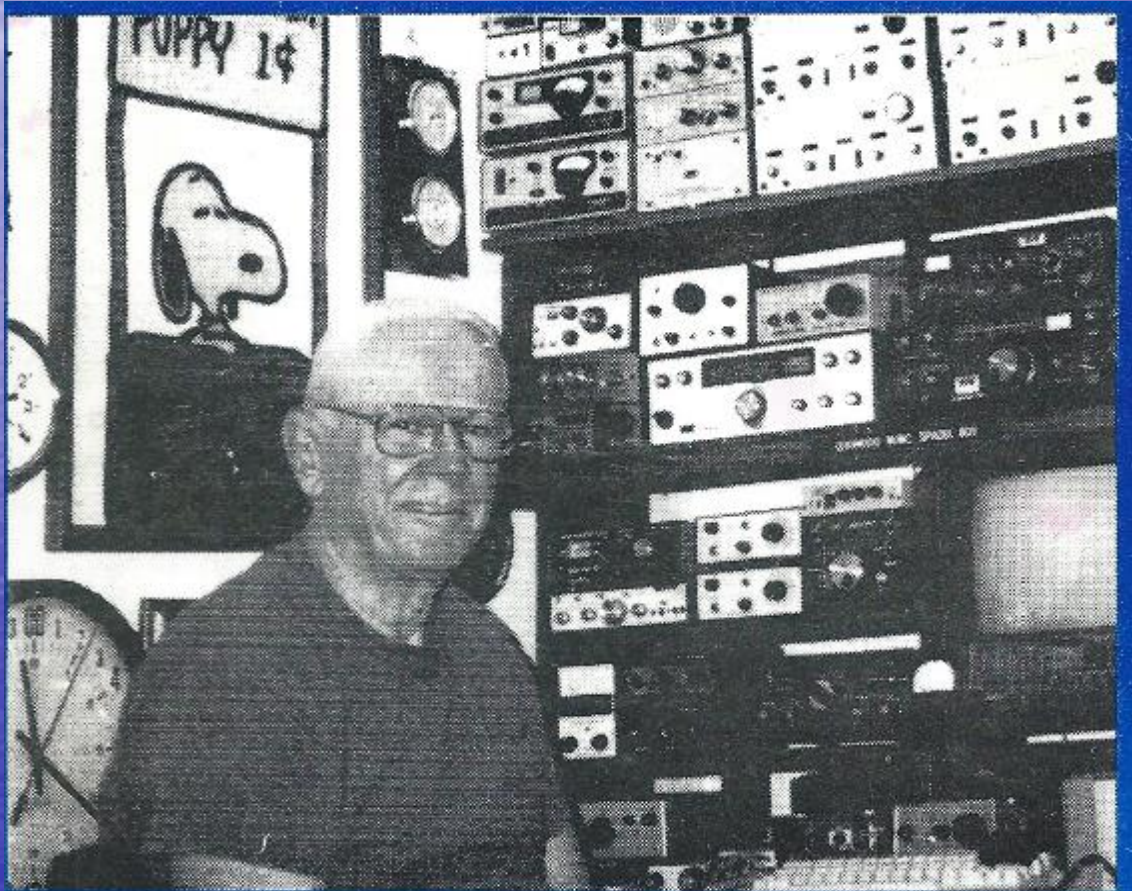


# Keep it simple? W2MSA





# Keep it simple? Even QRP Guys Collect Stuff



**Jim Cates, WA6GER**