

# QRP Presentation

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# 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 on a picnic table





# QRP in the field





# QRP at the park





# QRP at the beach





# 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)       |



# A Few QRP Links

- Neil Goldstein W2NDG
  - <http://fofio.blogspot.com/2015/07/radio-kit-guide.html>
- ARCI
  - <http://www.qrparci.org/links/qrp-kits-bits-and-supplies>

# Local QRP Clubs

- LIQRP

<https://www.qsl.net/liqrp/>

- W2LCW

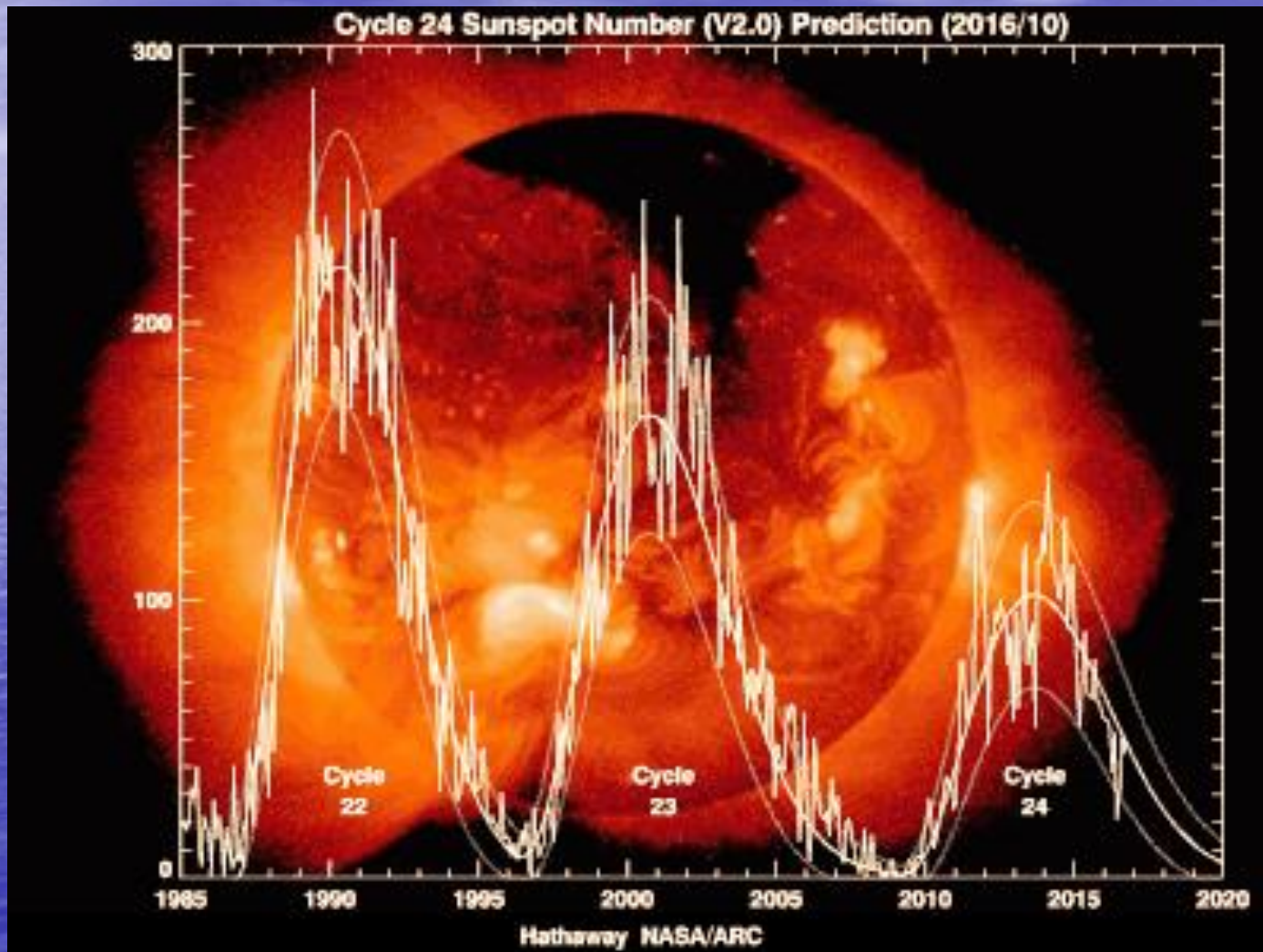
<https://longislandcwclub.org/>



# QRP Resources

| Table 11-6 QRP Operating 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,"<br><i>Worldradio</i> "QRP"<br><br><i>CQ Magazine</i> "QRP"   | A different technical or operating topic with every issue                          |

# SUNSPOT CYCLES

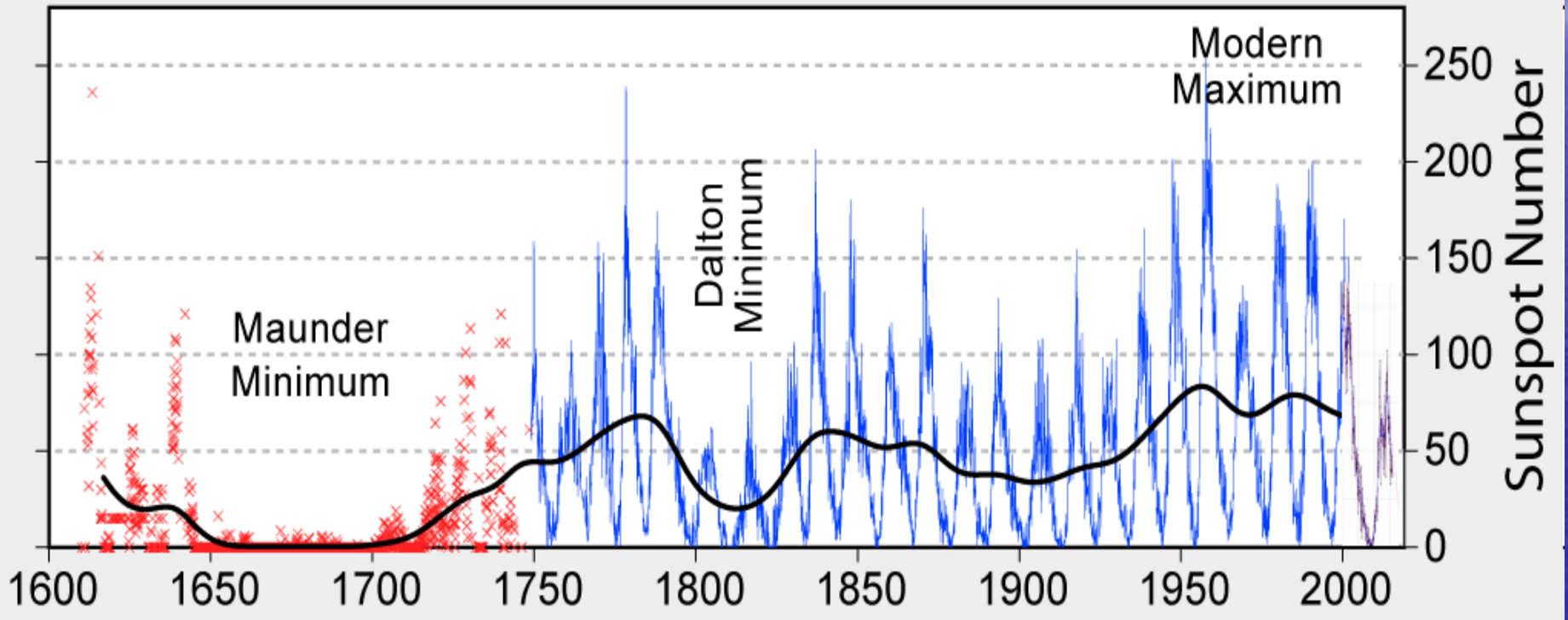


Next peak will be 2025



# SUNSPOT CYCLES

## 400 Years of Sunspot Observations



Next peak will be 2025



# **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



# QRP History Highlights

- 2017
  - QCX Transceiver - \$50
- Yaesu
  - FT-817
  - FT-818
- ICOM – had the IC-703
- Kenwood – had the TS-130V
- TenTec – had the Argonaut 599

The background is a solid blue gradient. On the left side, there is a bright, horizontal white and yellow glow that fades into the blue, resembling a sun reflecting on the surface of the ocean. The overall effect is a clean, professional, and serene aesthetic.

**EQUIPMENT**



# QRP Equipment

- Single Band or Multi Band
- 1 W, 2 W, 5 W, 10 – 15 W
- Kit or assembled
- Built-in tuner or not
- Built-in power source or not
- Built-in paddle or not
- Built-in keyer or not

# 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.





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**



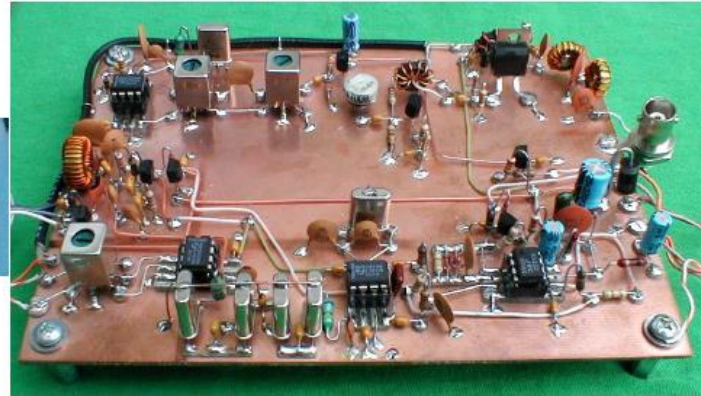


# QRP Equipment - Stability

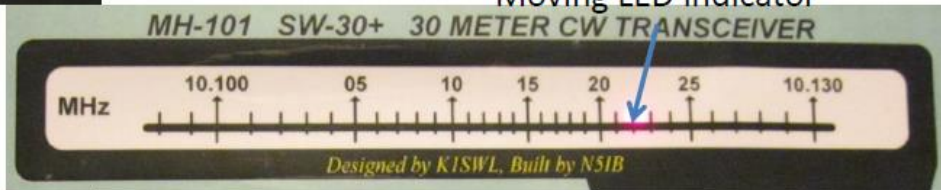
- Some are synthesized for rock-solid stability:
  - Elecraft KX1, KX2, KX3, and K2
  - Ten Tec's 40/20 or 40/30 (HB1A copies)
  - LNR MTR series



# A Nice Homebrew Example



Moving LED indicator



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

# My Favorite QRP Paddles

- Paddlette Model PK-1
  - No vertical arm movement (which is good)
- 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







**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
  - And it can display "amp hours"



# QRP Equipment - Power

- SLA Batteries – 2 V per cell = 12 V typ
  - Heavy but dependable
  - Use the right charger: Battery Tender Plus
    - [www.batterytender.com](http://www.batterytender.com)
- Lithium Ion – 11.7 V (3 cells)
  - Use the right charger
  - Must remove to charge
- NiMH (used in KX3) – 1.2 V per cell
  - AA sized cells. Charge while in the radio
- Alkaline Batteries – 1.5 V per cell
  - Not Rechargeable

# QRP Equipment - Power

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





**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

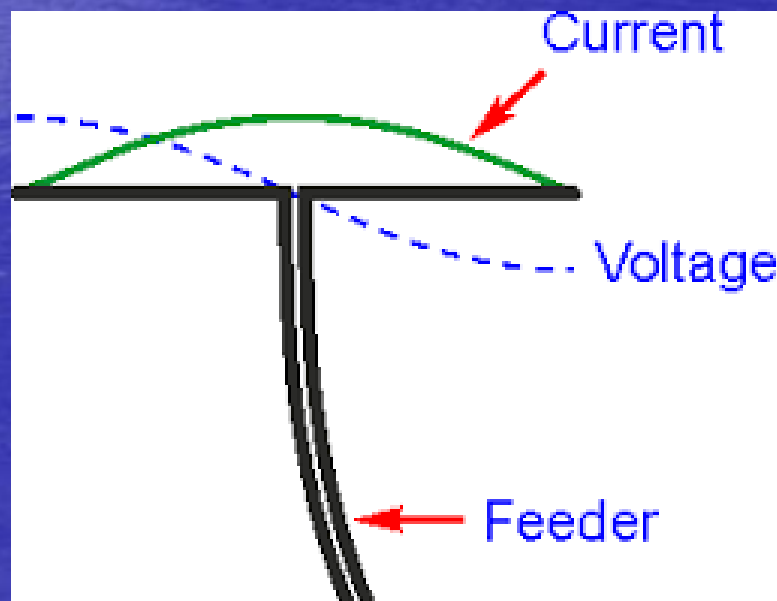


# QRP Antennas

- 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.

# QRP Antennas

- Laws of Physics (cont)
  - In order to radiate, a “standing wave” is needed on the antenna.





# QRP Antennas

- Standing Waves Example

Standing Waves on a String: both ends fixed.

- **fundamental frequency** - the lowest frequency, also called the first harmonic,

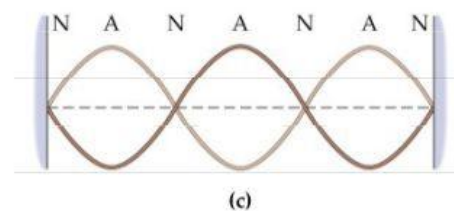
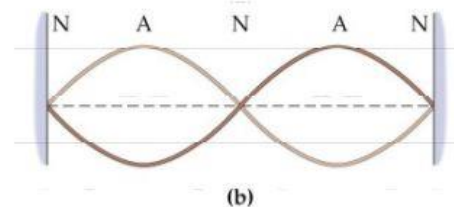
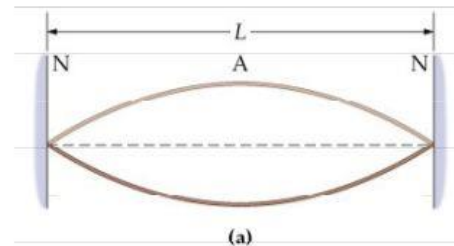
$$f_1 = v/2L \text{ and } \lambda_1 = 2L$$

- **second harmonic** - the next allowed frequency,  $f_2 = 2f_1$ .

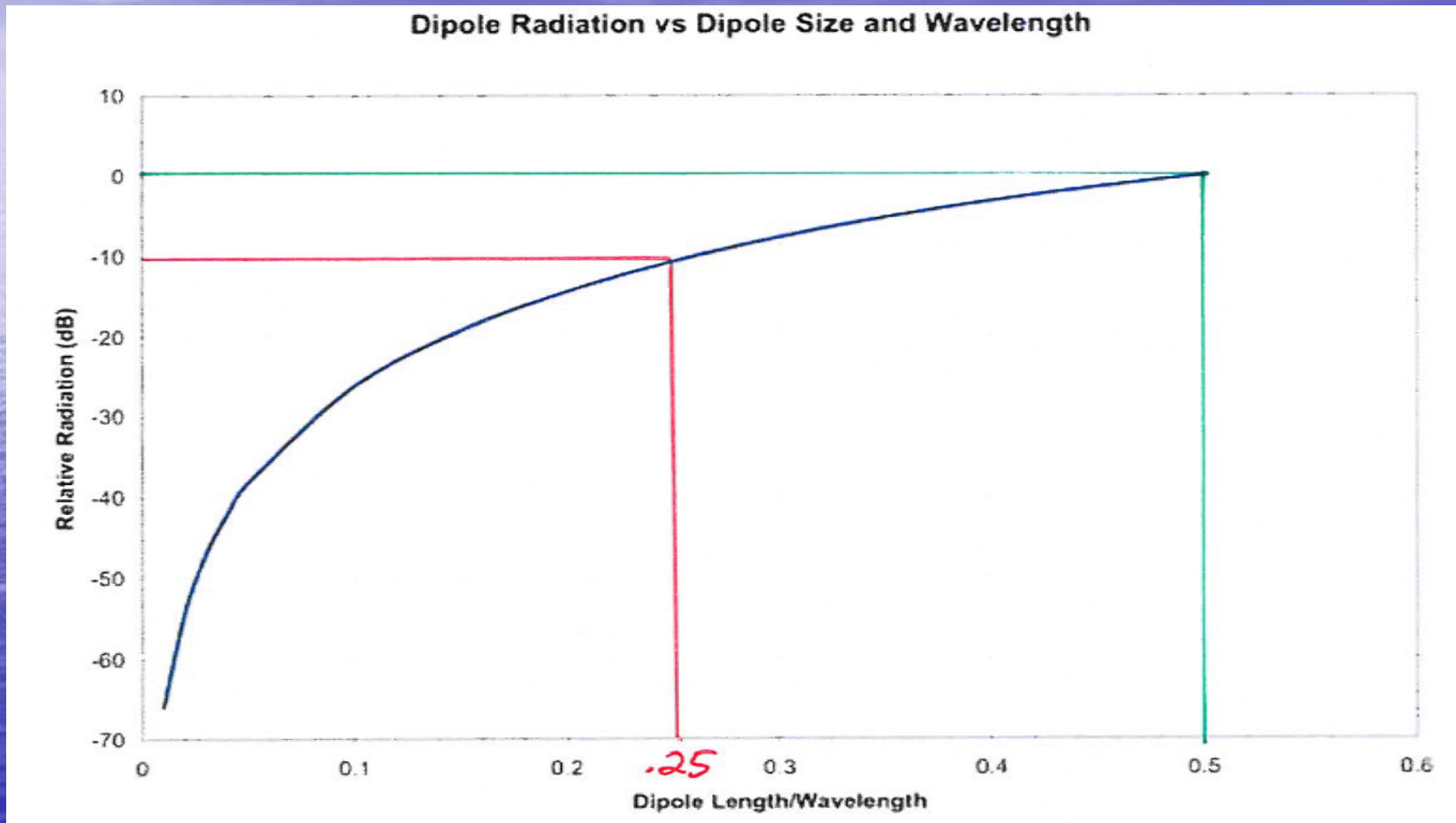
- In general

$$f_n = nf_1 \text{ and } \lambda_n = 2L/n$$

for the  $n^{\text{th}}$  harmonic on a string of length  $L$ .  $v$  is the velocity of waves on the string.



# Short Antenna Chart:





# 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!

# Antennas

- Popular QRP Antenna Types:
  - Dipole (CF, OCF, EF, Inverted Vee)
  - Vertical (Half Wave, Quarter Wave with radials)
  - “Random” Wire (with counterpoise)
  - Magnetic Loops
  - Short, “loaded” antennas



### 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/noxcal\\_blt.htm](http://www.qrpkits.com/noxcal_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.



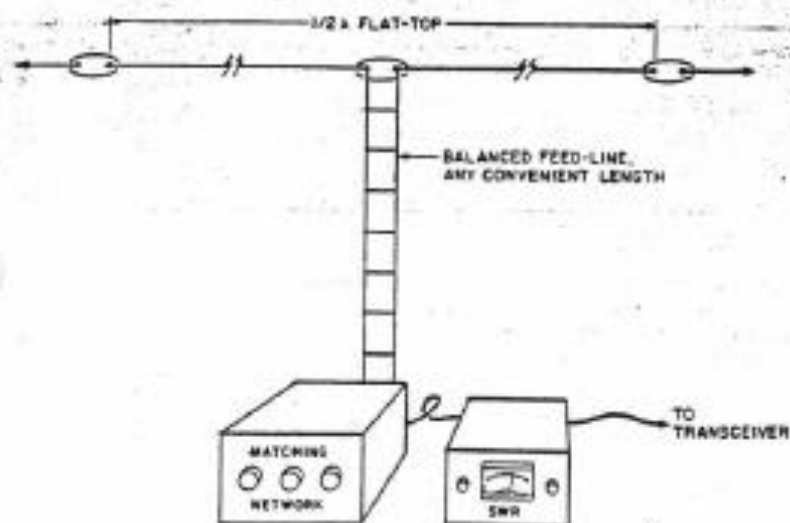
# Portable 40m to 10m Inverted V Antenna used by W2XS

- 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).

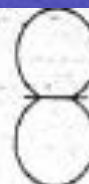
# Portable 40m to 10m Inverted V Antenna used by W2XS

- 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.





WAVELENGTHS  
ANGLES OF MAIN  
LOBES FROM WIRE  
GAIN / DIPOLE



1/2 λ

90°

0 dB



1 λ

52°

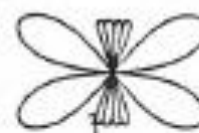
1/2 dB



2 λ

36°

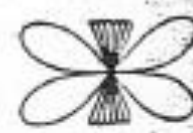
1/2 dB



3 λ

28°

1/2 dB



4 λ

25°

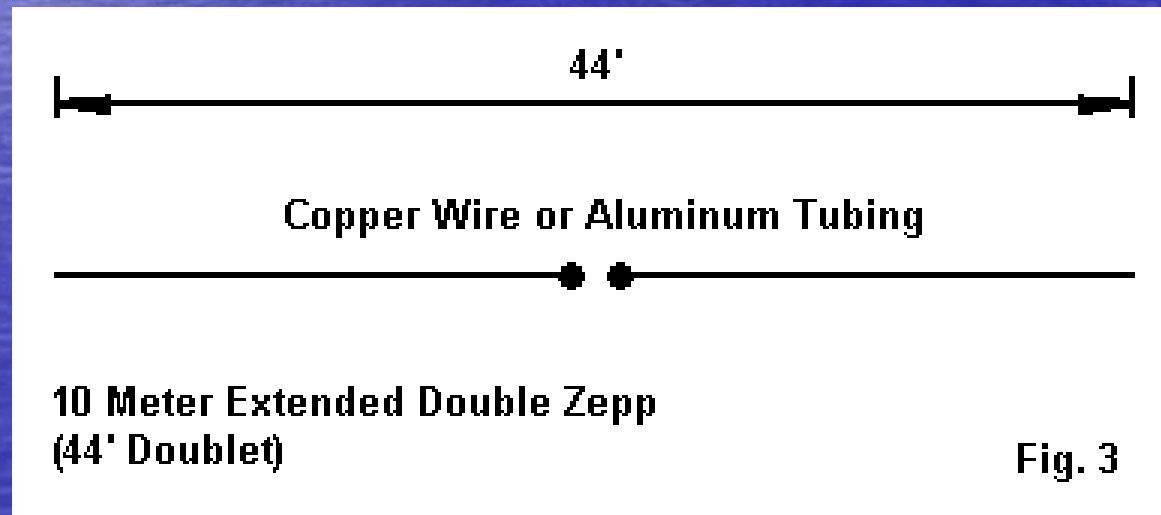
1/2 dB

WAVELENGTHS  
ANGLES OF MAIN  
LOBES FROM WIRE  
GAIN / DIPOLE

# 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

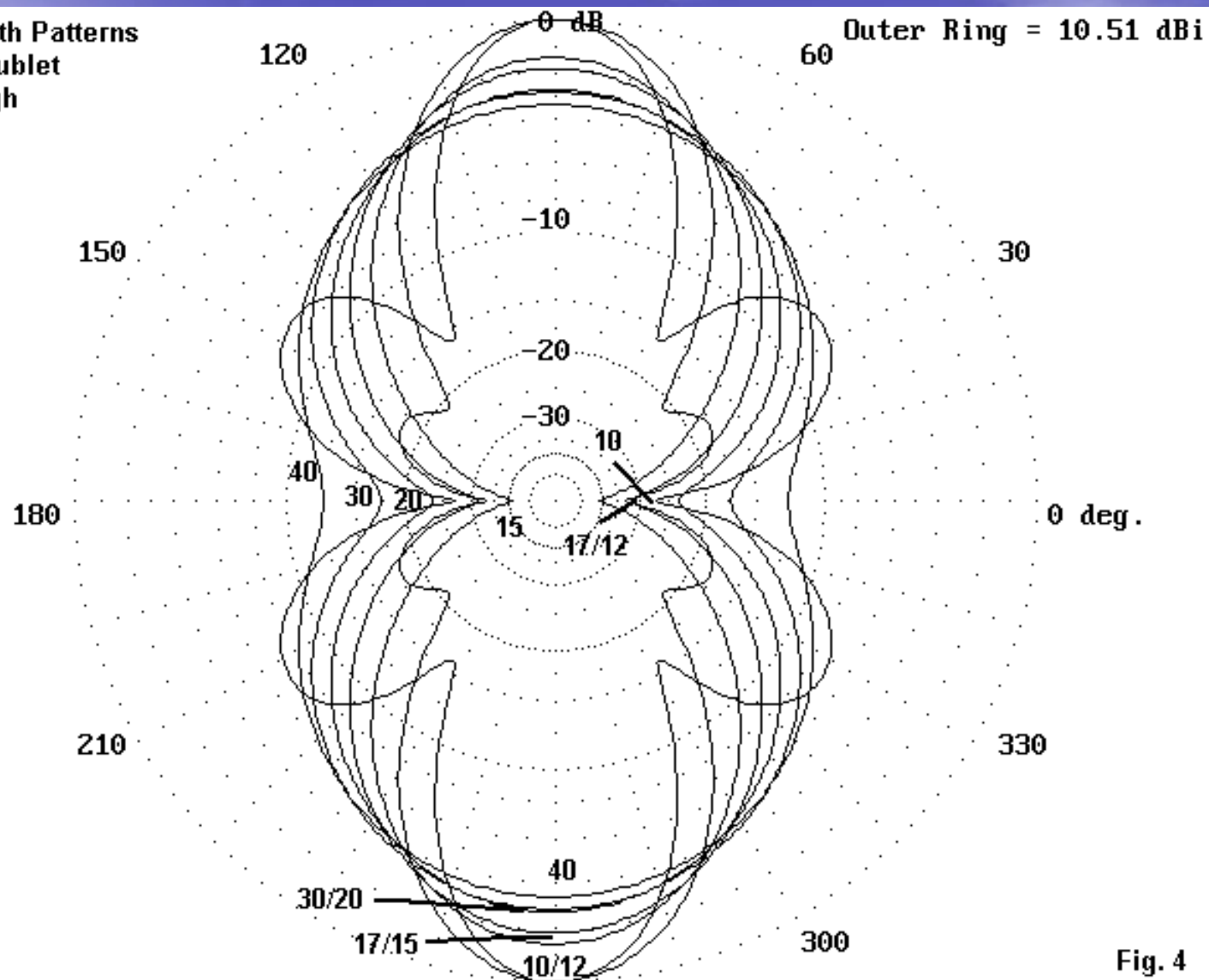
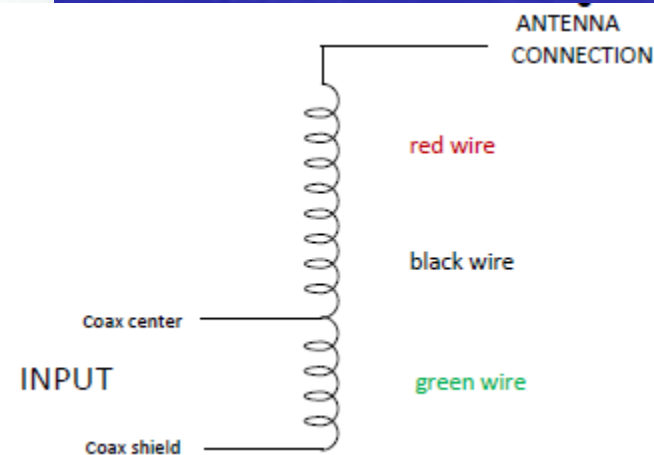


Fig. 4

# End-Fed Wire Antenna with 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.





# End-Fed Wire Antenna



# End-Fed Wire Antenna

Here are the final numbers  
in red below that would be good  
for a long-wire antenna:

**29 35.5 41 58 71 84 107 119**  
**148 203 347 407 423**

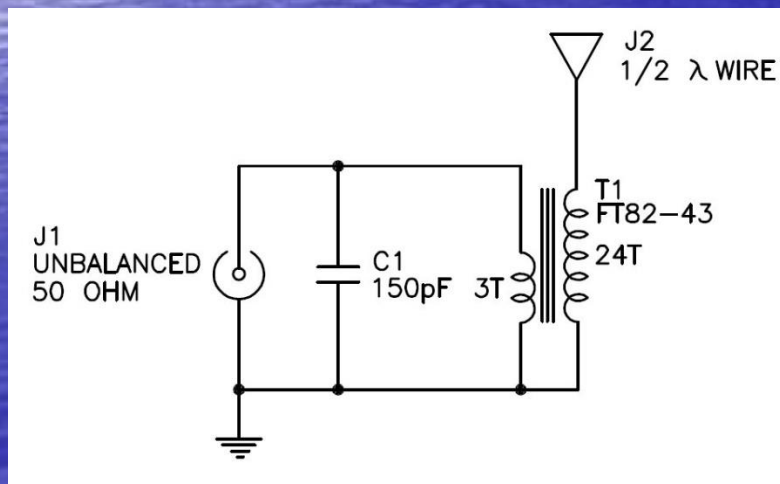
<http://www.hamuniverse.com/randomwireantennalengths.html>



# End-Fed Halfwave Antenna

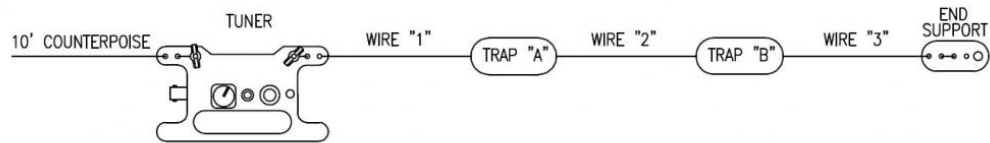
Normally a 1-band antenna

QRP Kits copied LNR/PAR



# End-Fed Halfwave Antenna

## Multi-Band Versions: Traps or Loading Coils

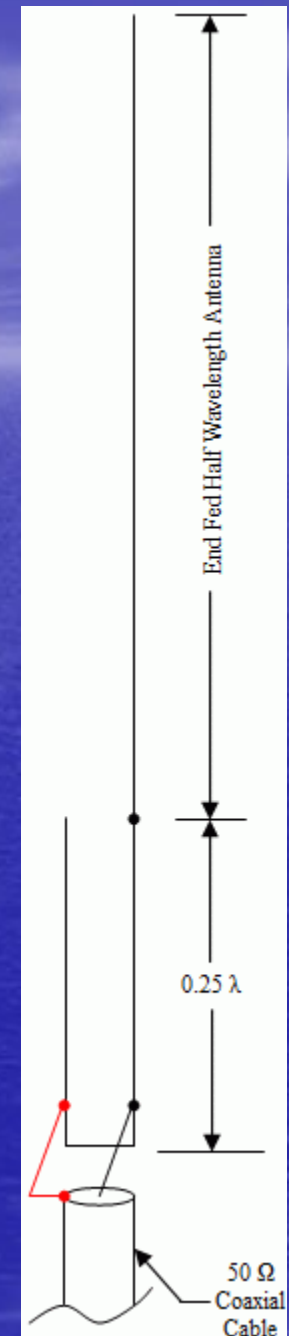


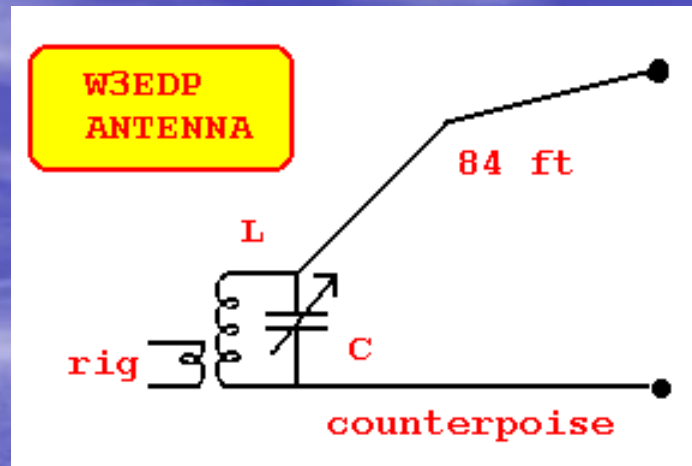


# End-Fed Halfwave Antenna

## The J Pole

$\frac{1}{4}$  Wave Matching Section  
 $\frac{1}{2}$  Wave Radiating Section  
Mono-band Antenna





The Tuning capacitor 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.



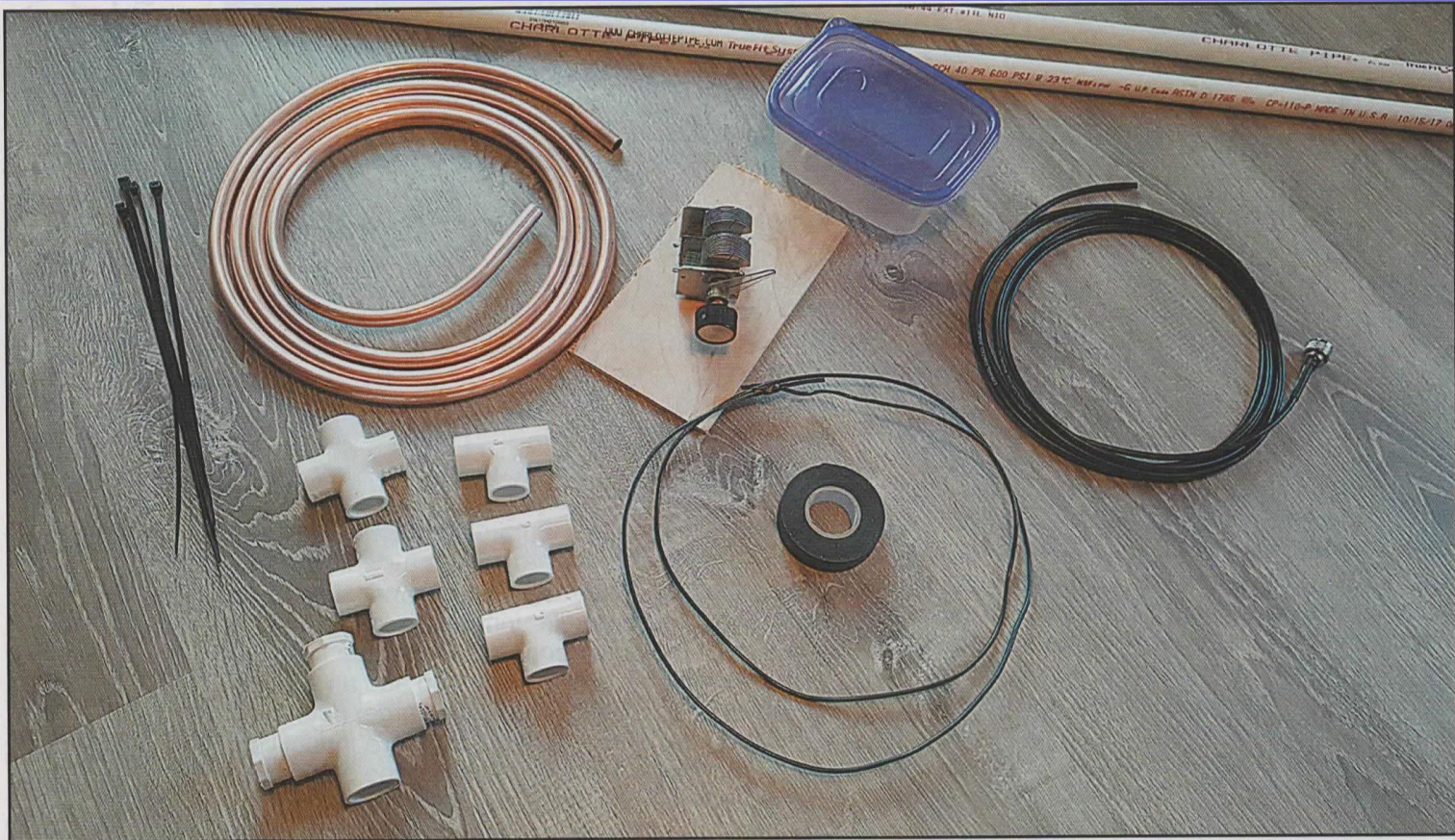
# Magnetic Loop (W4OP - PAR)





# CQ Mag – June 1, 2018

## \$35



*Photo B. Materials for the loop — not a lot to gather!*



# Loaded Whip

Highly Portable but the poorest radiator. Absolutely need a counterpoise.



# This guy can't be married!

## A mobile station for QRP





# My Recommendations and Things You Can Build

W2XS

# Rig (kit)

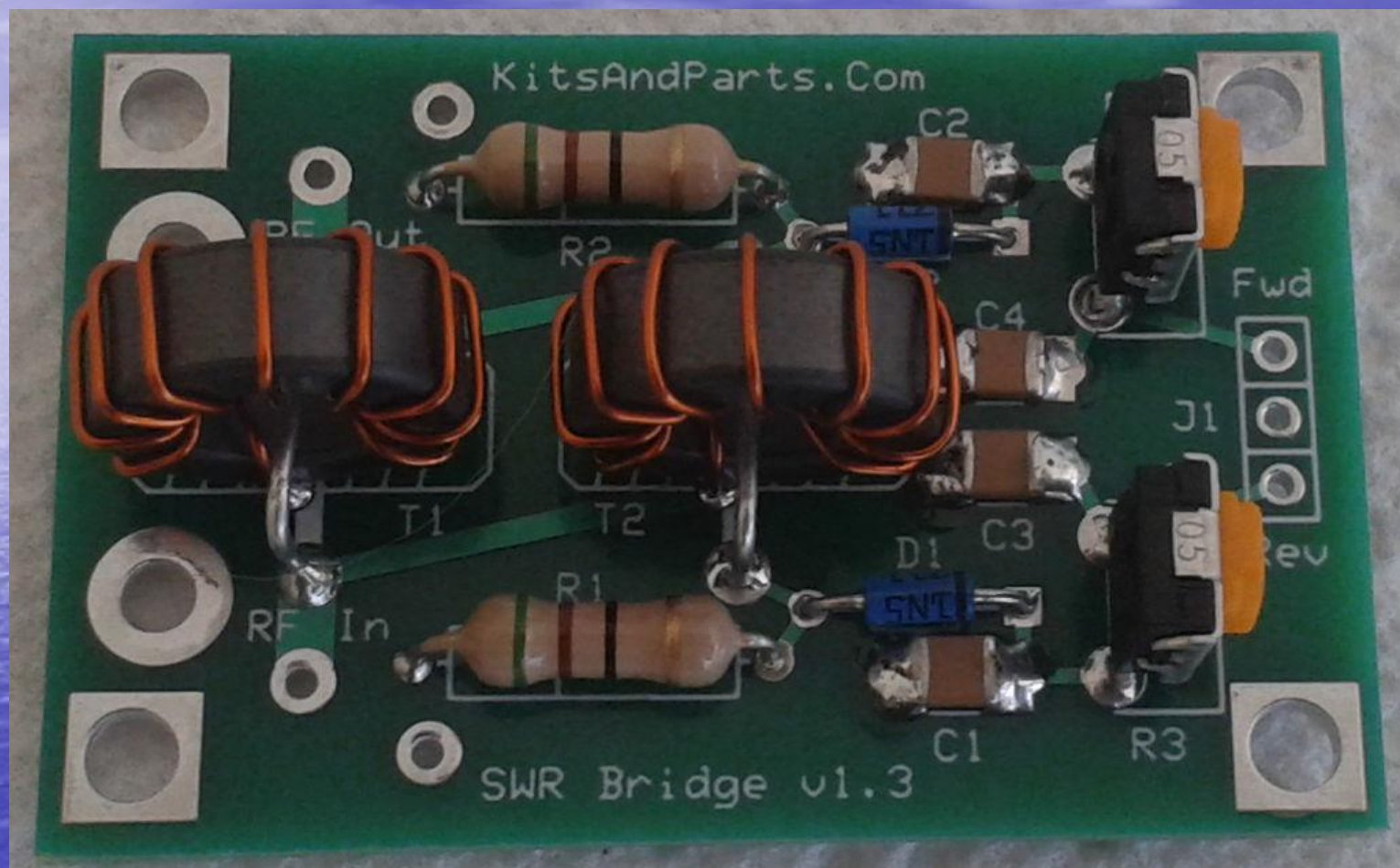
- LNR MTR 3 or 5
- QRP Kits PFR3 (\$250) 5 W+
- OHR 100A (\$150) 5 W+
- Elecraft K1 (\$300 to \$400+) 6 W+
- Elecraft KX1 (\$300 to \$400+) 3 W
- Elecraft K2 (\$600+) 10 W+
- Elecraft KX2 or KX3 (10 W or 15 W)
  - Look at eBay or eHam.net
  - Good QRP link:  
<http://www.amqrp.org/misc/links.html>



# Things you can build

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

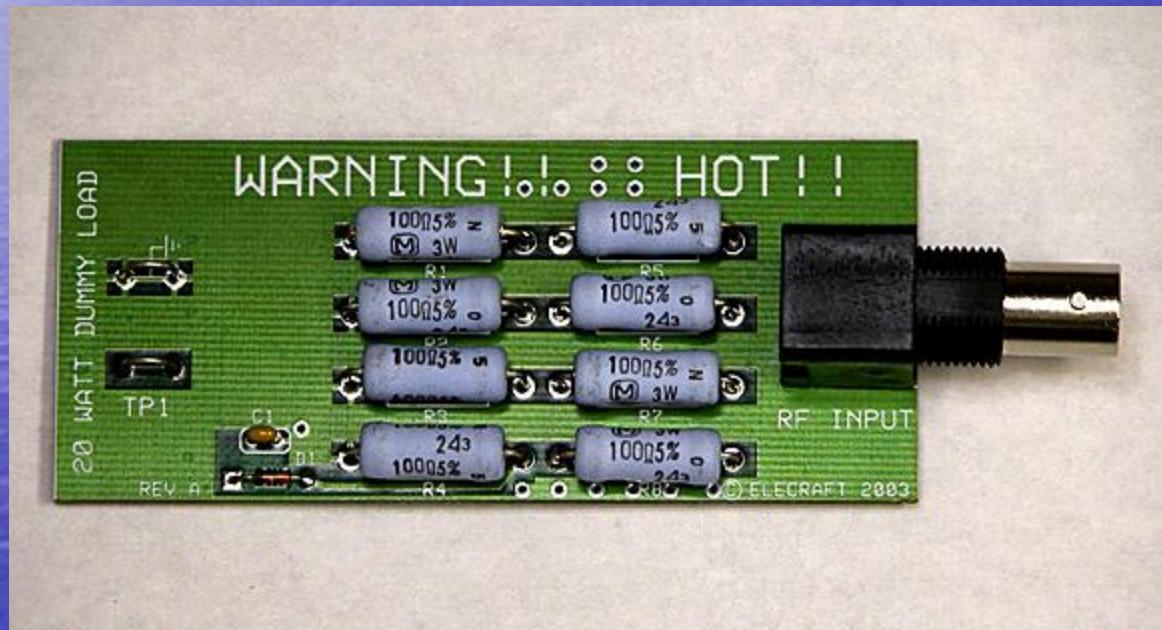
# SWR kit for \$8





# Dummy Load kit for \$26

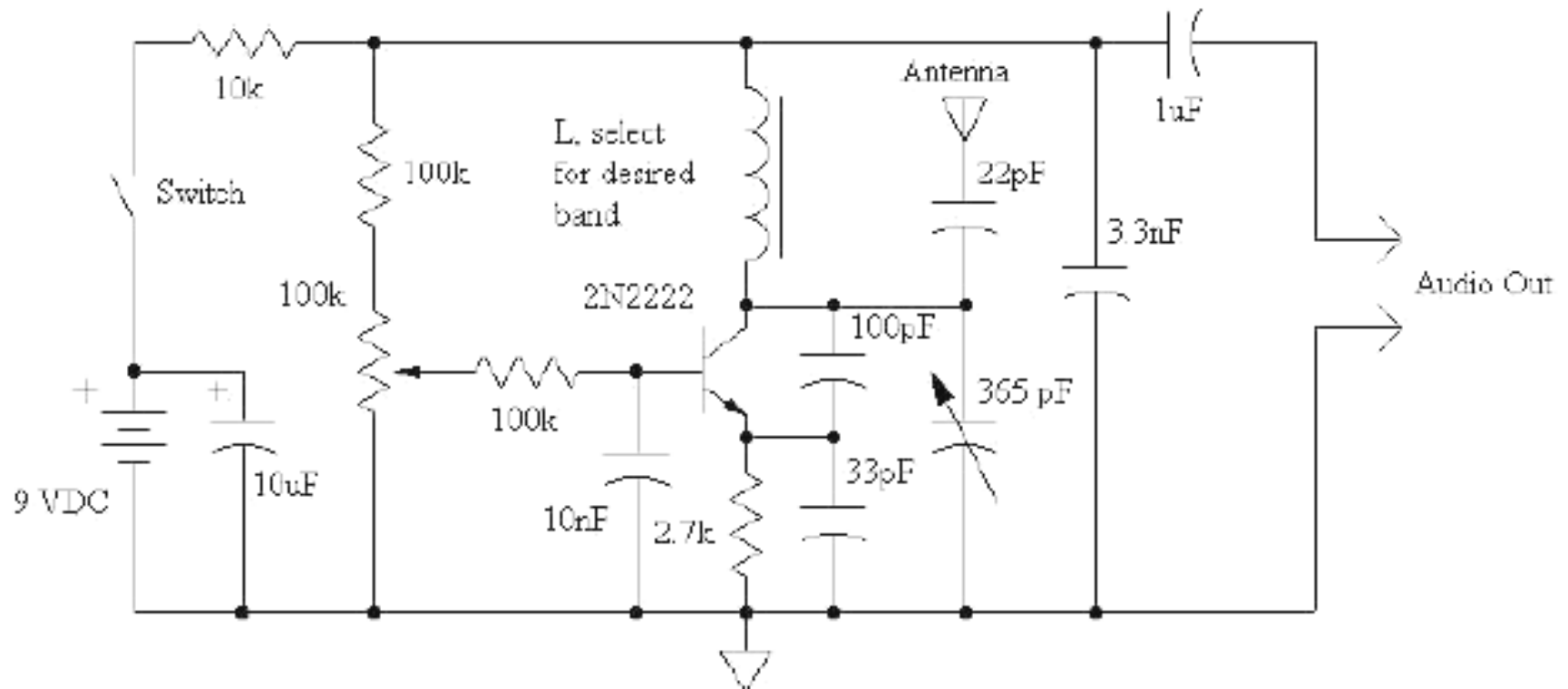
## Can measure power with a voltmeter



# A simple regenerative receiver

## No tapped coil needed

[www.techlib.com](http://www.techlib.com)



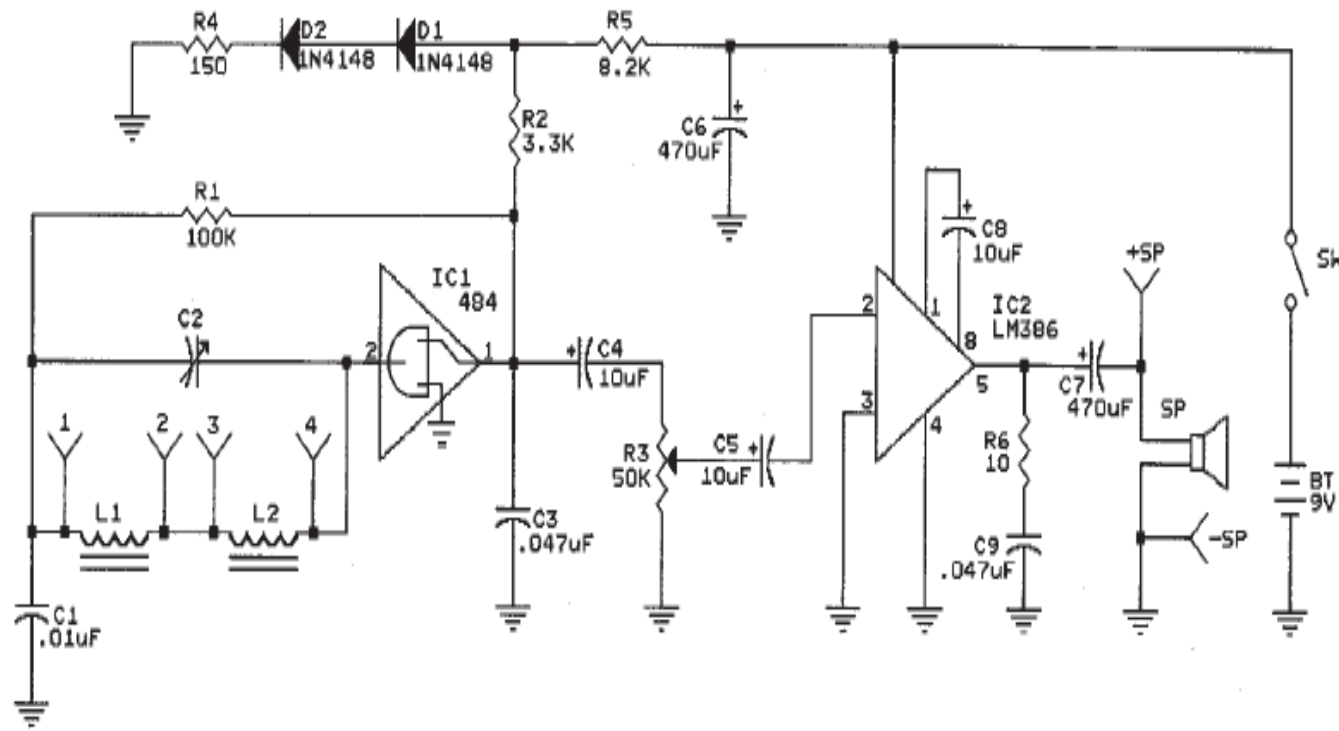


# A simple regenerative receiver Similar to this one [www.4sqrp.com](http://www.4sqrp.com)



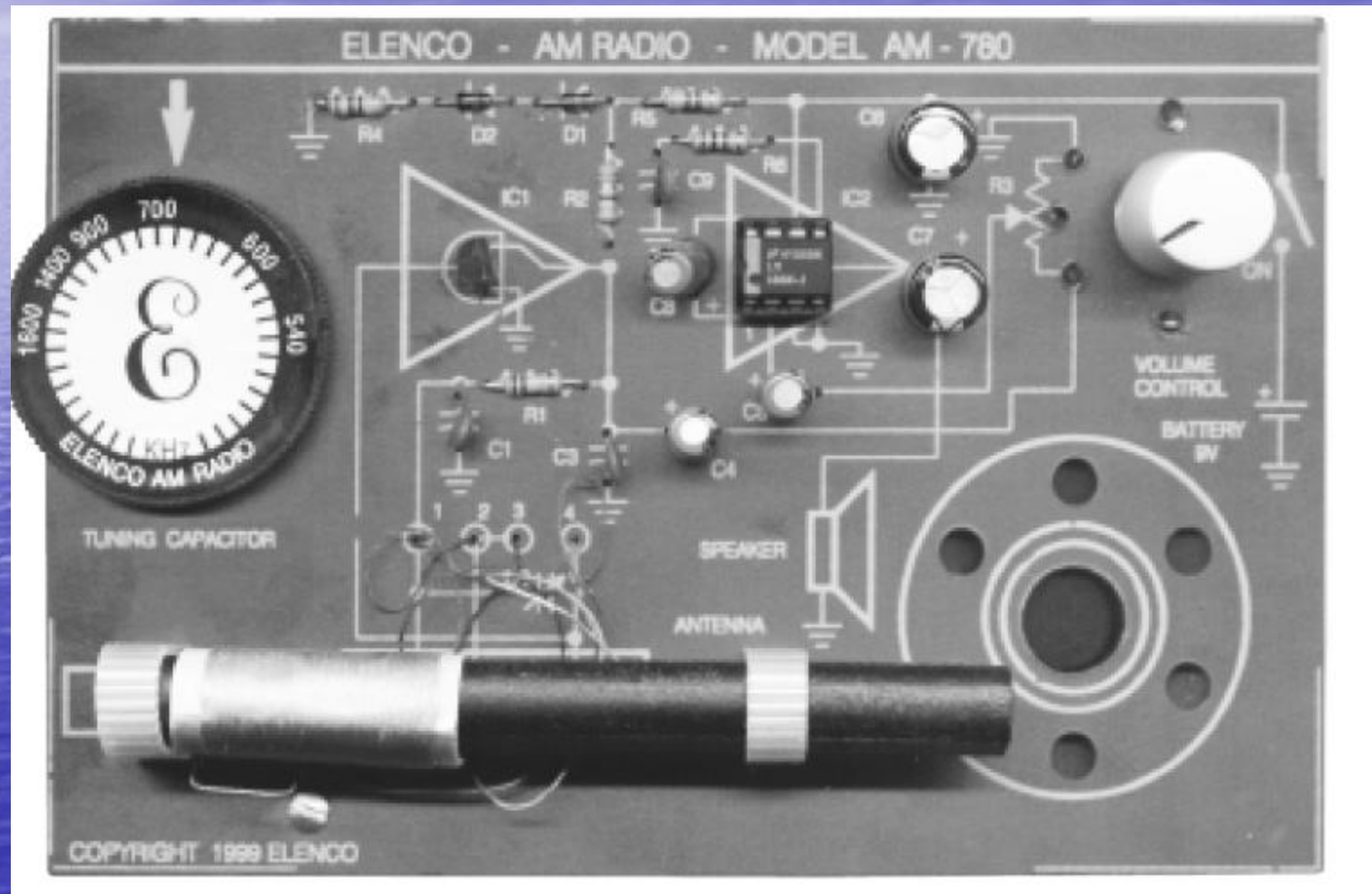
# A simple TRF AM Radio - MK484

## SCHEMATIC DIAGRAM AM-780K

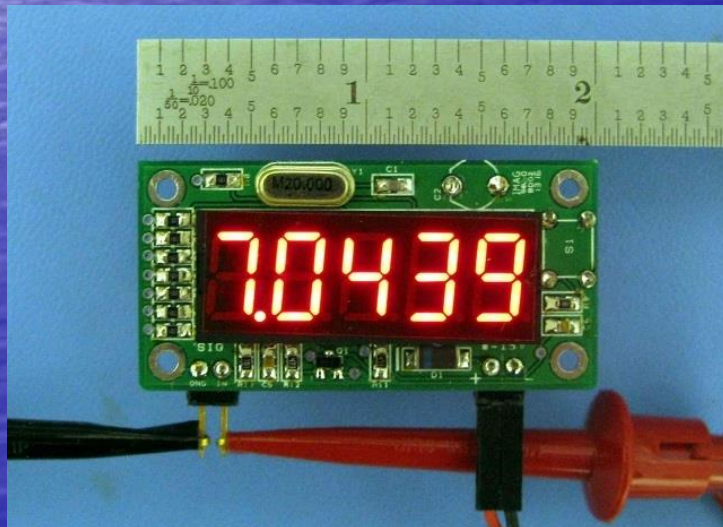




# A simple TRF AM Radio - MK484



# Qrpguys.com sells nice stuff

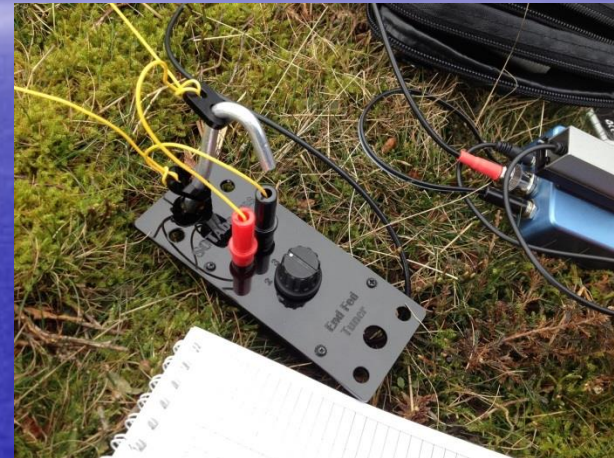
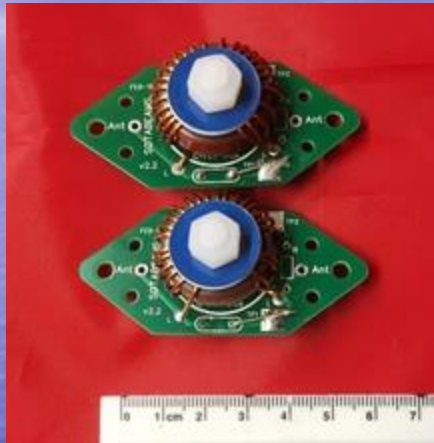




# Qrpkits.com does too



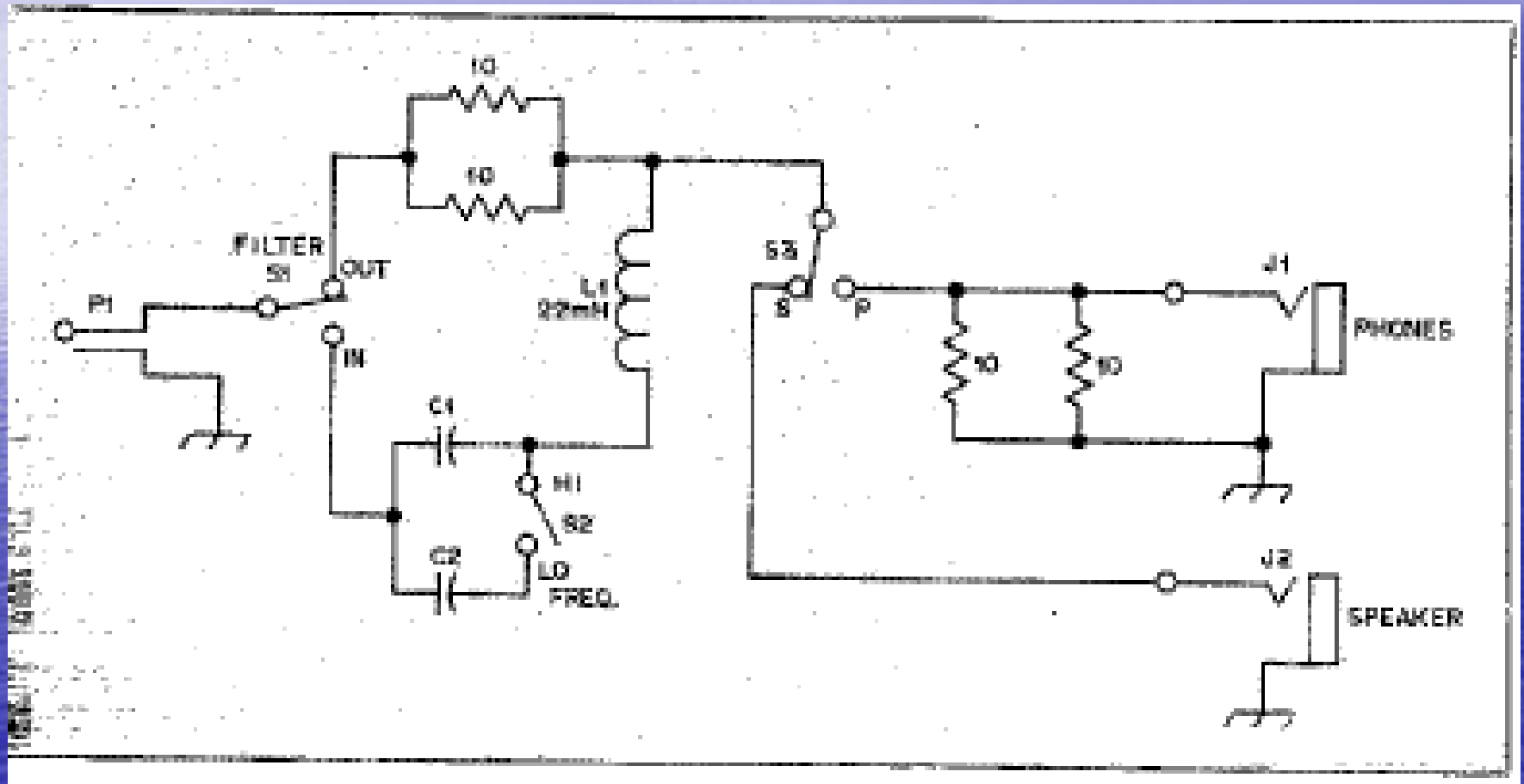
# Sotabeams.co.uk does too



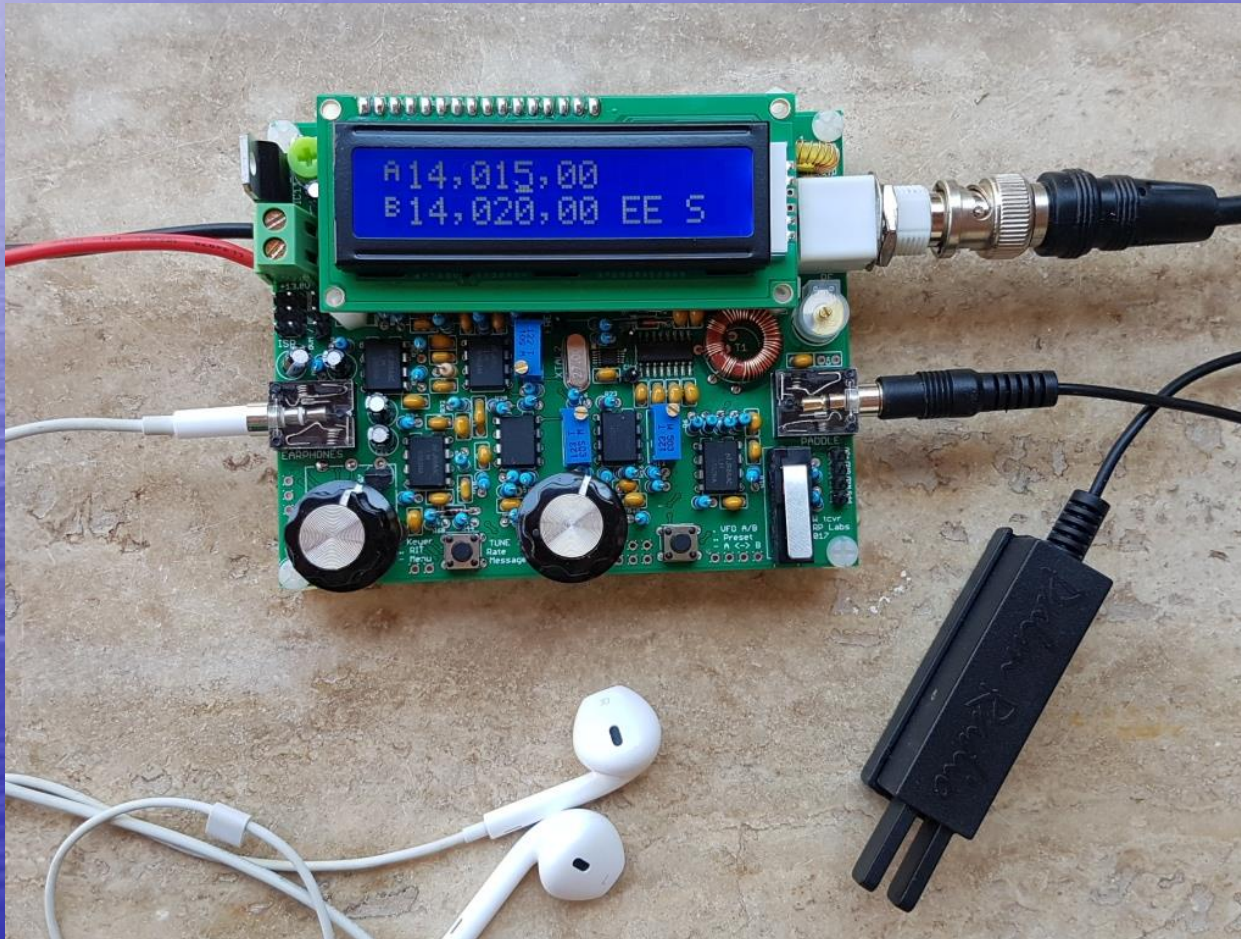


# Passive Audio Filter

## QST November, 1977



# QRP Labs QCX 5W - \$50 kit





From QRZ.com - Emtech - \$50



# From QRZ.com - \$650 for all FT817 + LDG Tuner





From QRZ.com - \$575  
FT817 w/CW Filter



From QRZ.com - \$445  
Never saw one of these before





# From QRZ.com - \$50 QRP Antenna System



# From QRZ.com - \$300

## LNR MTR5





# From QRZ - \$85 OHR QRP Wattmeter



From QRZ.com - \$178  
OHR 100A





From QTH.com - \$110  
SWL DSW-II  
Compare to 4SQ Hilltopper



# 4SQRP Hilltopper - \$97

## Designed by K1SWL





# From QTH.com - \$500 Wilderness Sierra w/6 Modules



# From QTH.com - \$415

## Index Labs Plus





From QRZ.com - \$550  
Elecraft K2 S/N 2699



From eBay - \$98  
ME Electronics SW40+  
Re-introduction of SWL Kit

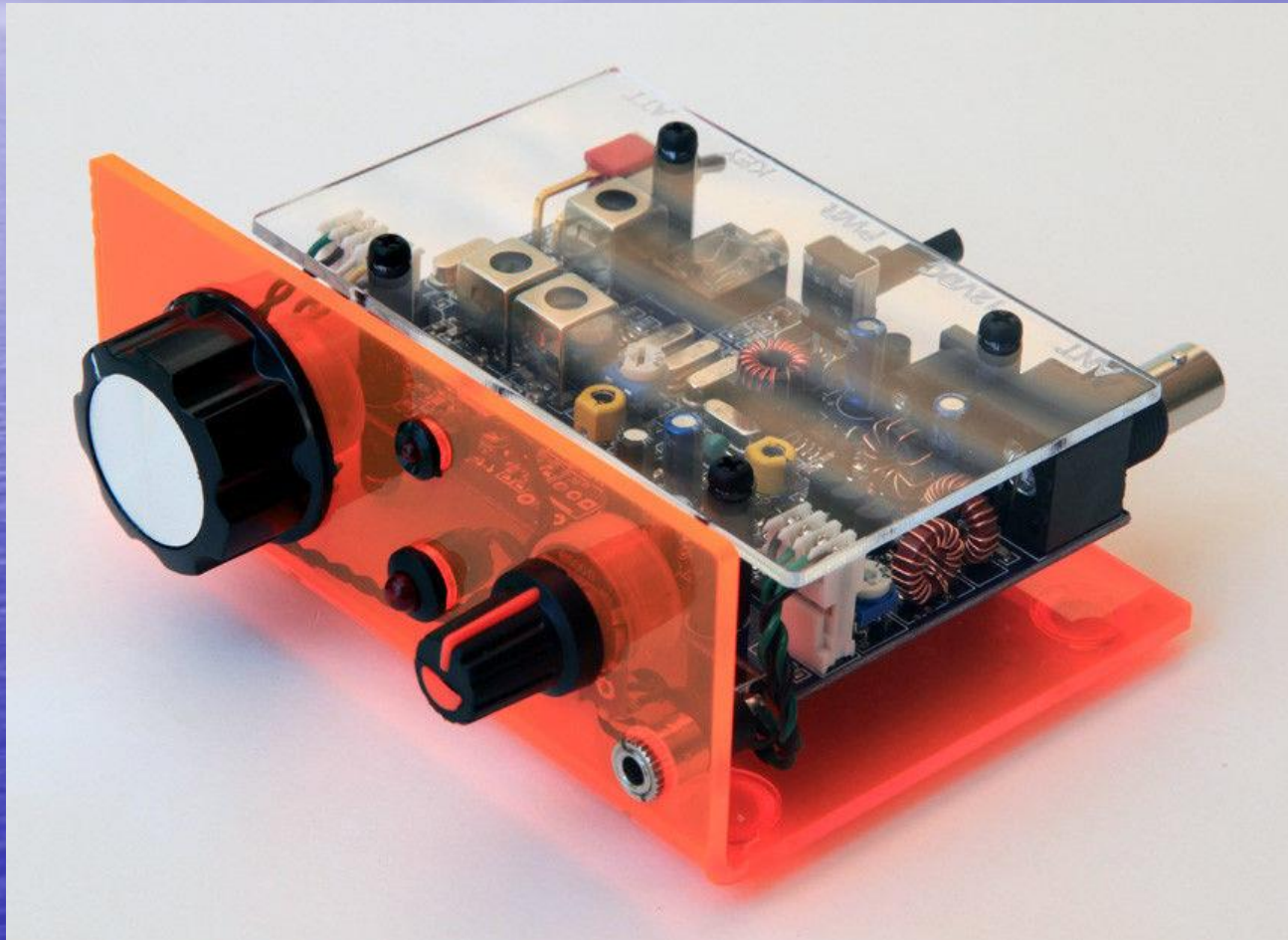




From eBay - \$210  
Ten Tec Argonaut 505  
Choose 509 or 515 instead



# From eBay - \$115 WA3RNC QRP 40 Kit





From eBay - \$166  
WA3RNC QRP 40 - Built



From eBay - \$165  
W2LI Loop Antenna – 3 Bands  
40, 30, and 20





From eBay - \$571  
Elecraft K1- 2 Bands  
I think too high – and dirty!



# From eBay - \$469

## Topcyberday – Many Features But Be Careful!





# eBay Thief - \$570 (\$127 shipping) Be Careful!



# 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? K3OMI





# Keep it simple? W9EVT (1 of 44)





Keep it simple? W9EVT (2 of 44)  
Look him up on QRZ.com



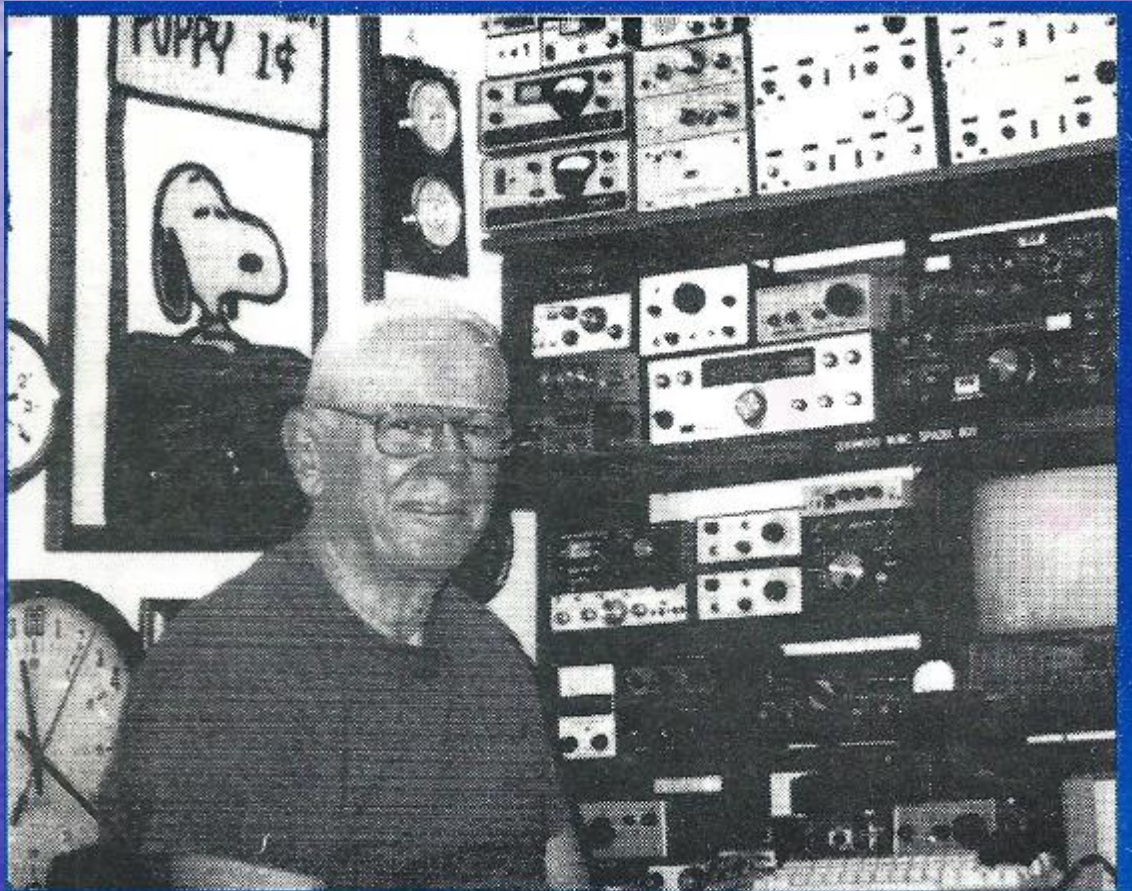


# Keep it simple? W2MSA





# Keep it simple? Even QRP Guys Collect Stuff



**Jim Cates, WA6GER**



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.





Thank you! CUL  
73,

John W2XS