



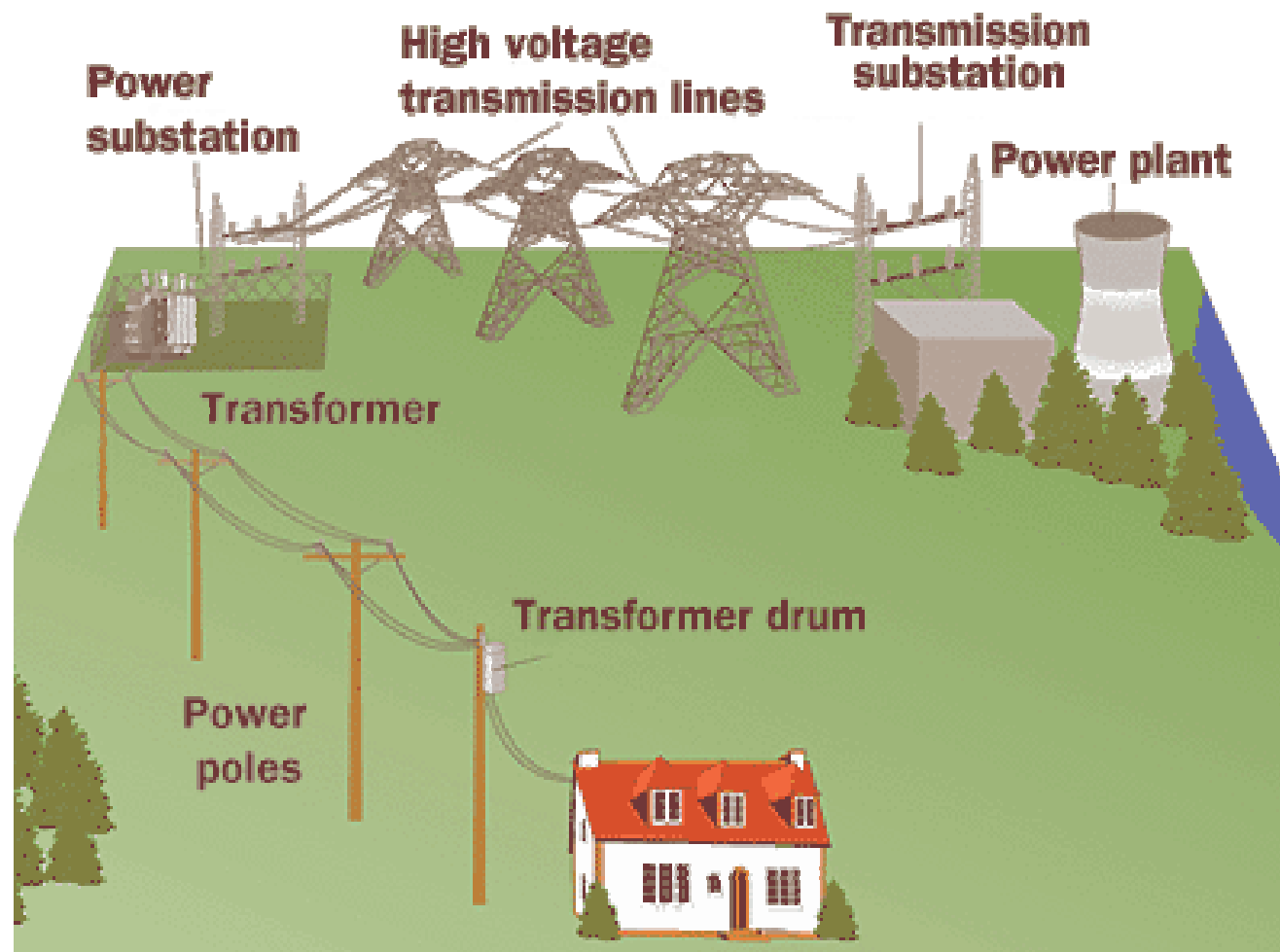
# Powerline Interference and the Amateur Radio Operator

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Bill Lynch, AB2UW

RCARC Meeting 10-24-2007

# Electric Power Distribution





# 138,000 volts, 3 phase

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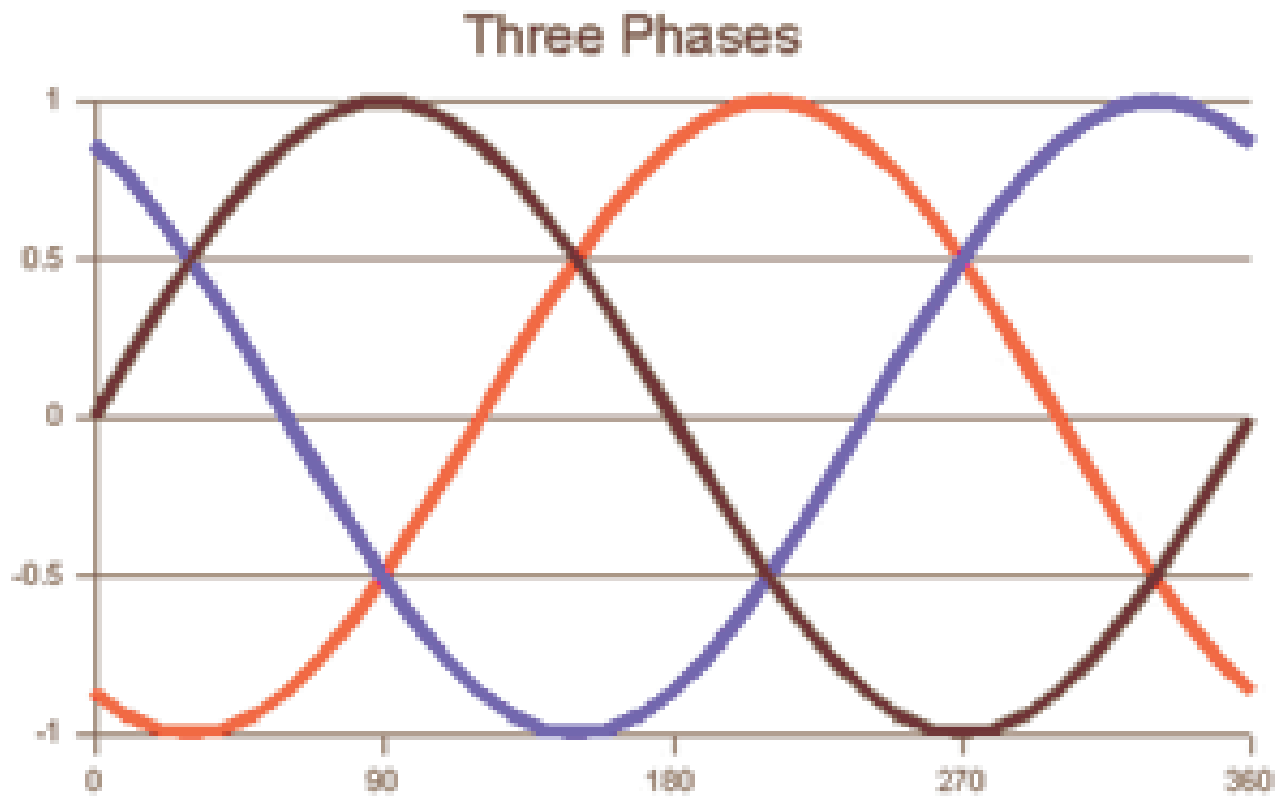


13,200/7620 Volts wye

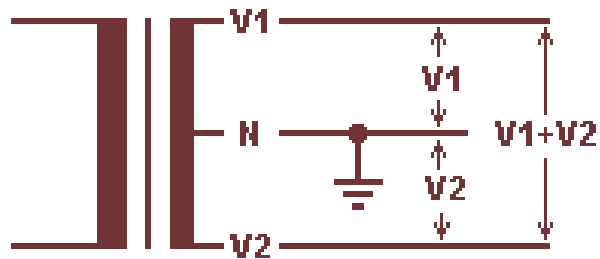




# Three-phase power



# 7620 V to 120/220V



EXAMPLE USA  
V1, V2 = 120 Volts  
V1+V2 = 240 Volts  
EXAMPLE EUROPE  
V1, V2 = 230 Volts  
V1+V2 = 460 Volts



# My “pole pig”





# Let's Hear It!

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- Continuous and Intermittent noise







## Time to call email LIPA?

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- Mike Malinowsky, N2QOY deals with powerline interference for LIPA
- 23 years doing this
- 1500-2000 complaints handled per year
- 50% are actual utility pole problems
- The other 50% is always electronic, caused by the consumer!



# Test if it's You or Them!

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- Run your radio on battery power
- Turn off the MAIN circuit breaker
- See what the noise does!



# Some in-home noise sources

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- Electric Blankets \*
- Computers \*
- Heating Pads (of all kinds)
- Furnace Control Circuits
- Refrigerators
- TV Top & Stereo, Amplified Antennas
- Plasma Television sets
- Light Dimmers \*
- Aquarium Heaters \*
- Screw In Photocells
- Low Energy Compact (screw in) Florescent Lights
- Touch Control Lamps
- Clean Air Machines (table top and furnace type)
- Door Bell Transformers



## If it's LIPA:

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- Of the 50% actual utility pole problems:
  - 1 % are at the 120-240V
  - 5 % are above 69kV
  - 94% fall in the 7.62kV-13.2kV range



# My QTH





# Start with an AM radio

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- Car radio can be used – convenient
- Portable AM radio better
- AM radio has directional loop antenna
- Put portable AM radio next to ground wire of utility pole if you get noise from several poles
- Let's try it!



# Switch to your HT

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- AM mode = best
- Higher frequency = better localization, but may be weaker
- Put antenna next to ground wire
- Let's try it!



# Add a directional antenna to your HT

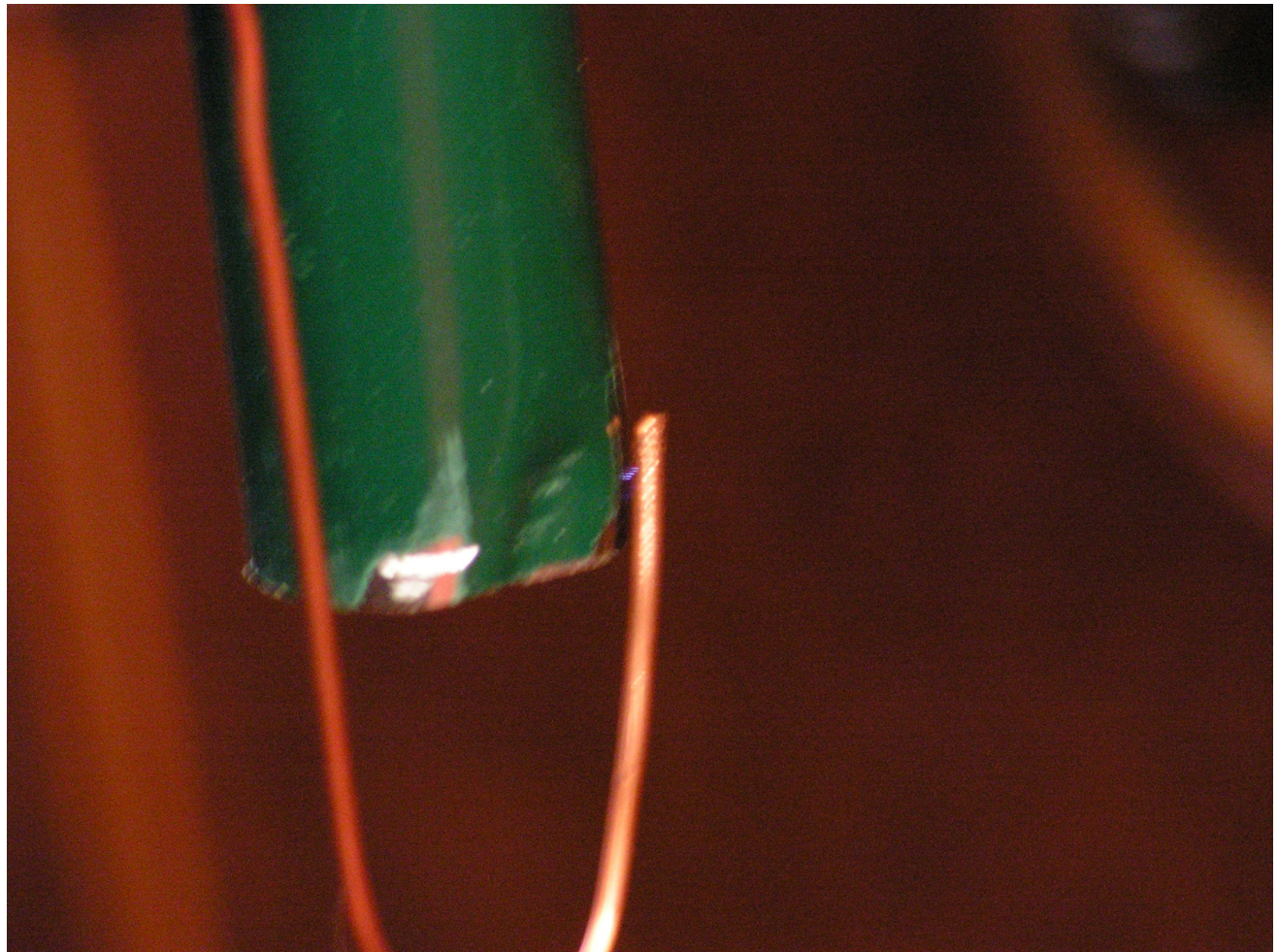
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- Can EASILY get location of noise down to one powerpole
- Can also use portable directional antenna for fox hunting, satellites, portable/emergency operation
- Example: Cushcraft A44911S, 440-450MHz, 4.2 ft. boom, 20dB F/B, 13.2dBi gain, 11 elements \$89.95 at R&L
- Or . . . Antenna Book has plans for antennas
- Let's try it!



# What causes powerline noise?

- Sparking!
- Corona discharge noise  
infrequent





# Electric Field/Capacitance

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- 7620V to ground spark will blow fuse in one phase-happens very INFrequently
- Voltage INDUCED on metal object by electric field/capacitance sparks to ground and causes RFI
- Amazing amount of RFI at VHF/UHF from tiny spark
- Let's try it!



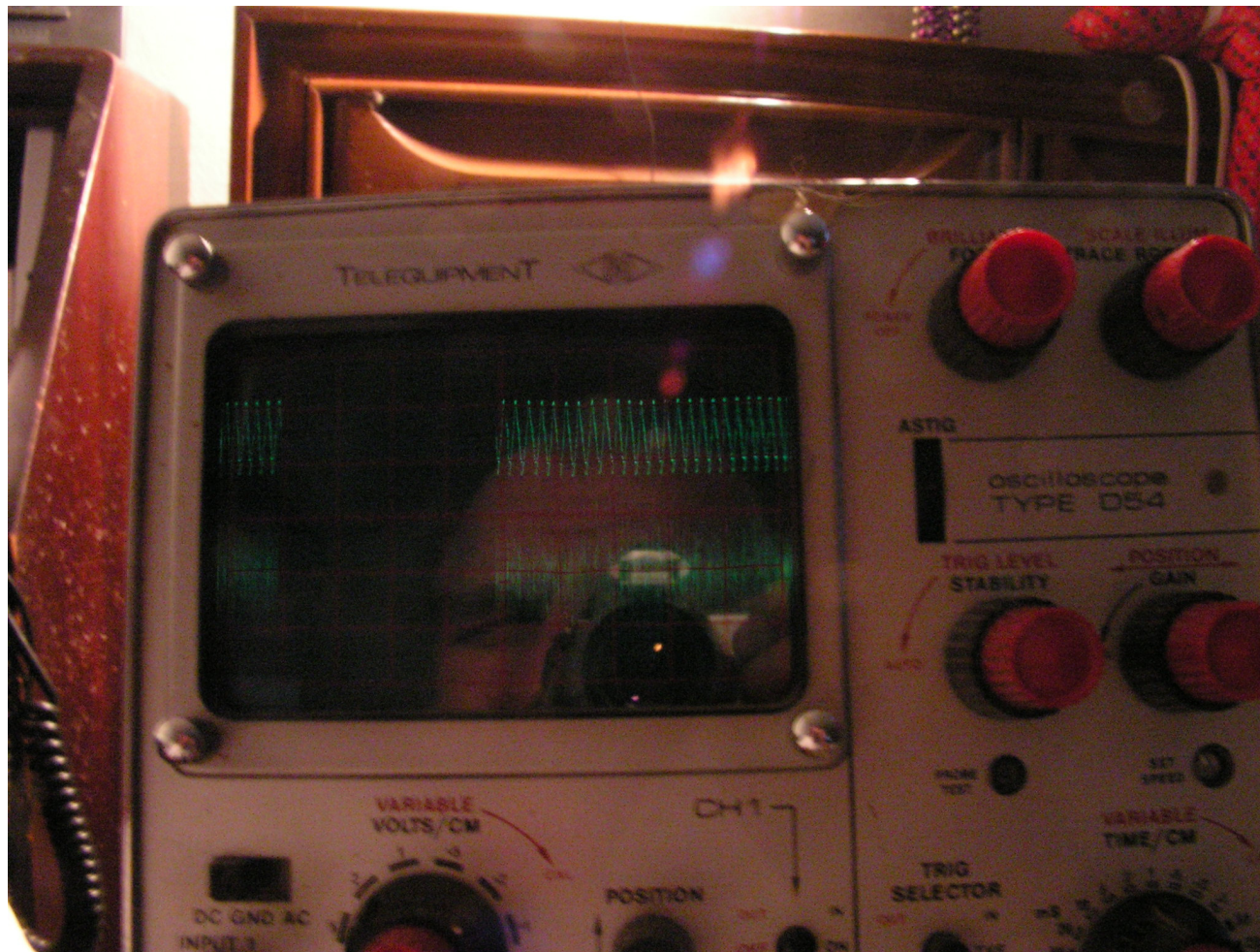
# Variation with Weather

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- Very dry=MORE sparking/noise
- May take several dry days for pole hardware to dry out (my case)
- Rain/dampness/dew usually SUPPRESSES powerline noise
- Let's try it!

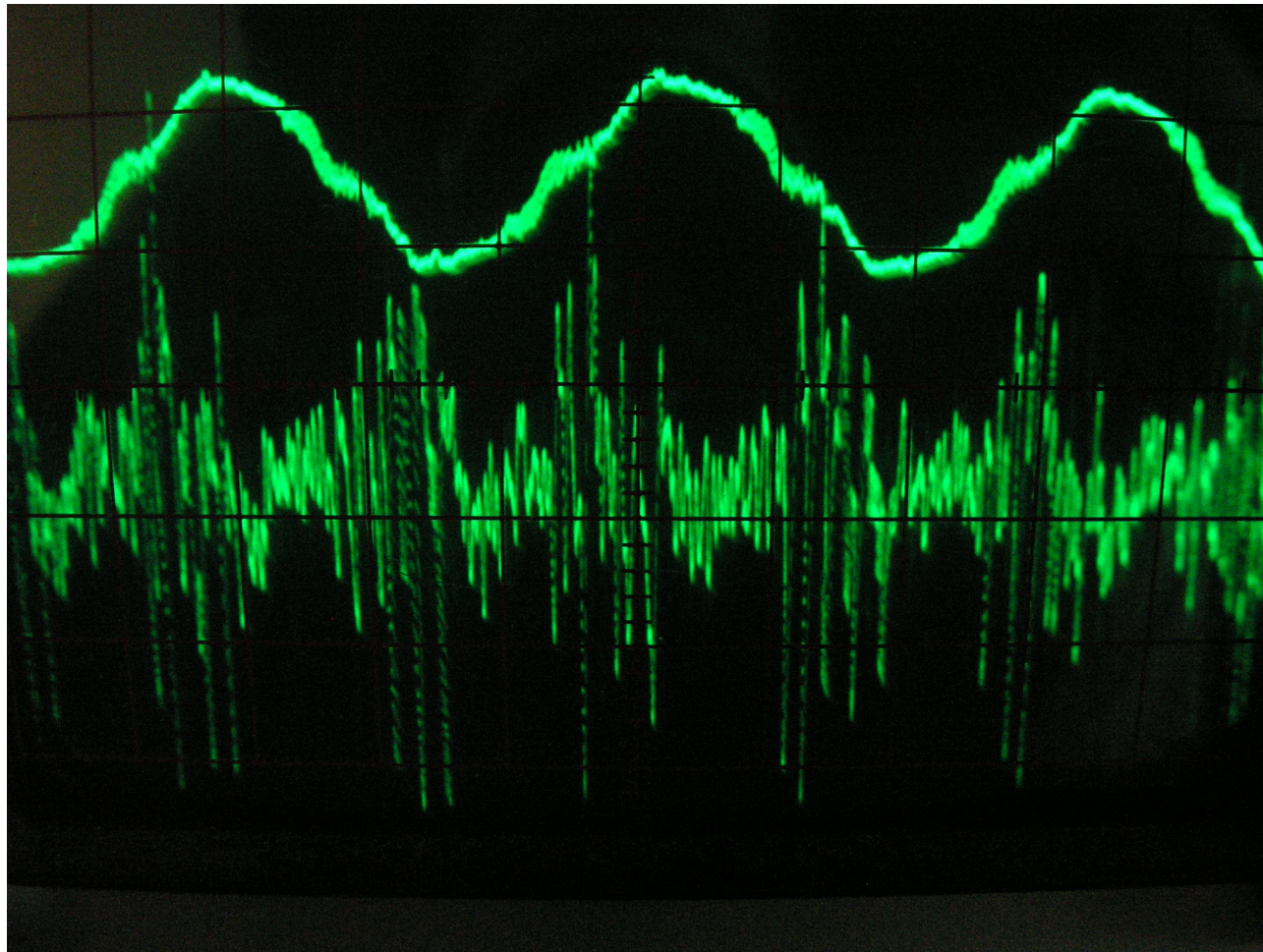


# Use scope to confirm sparking

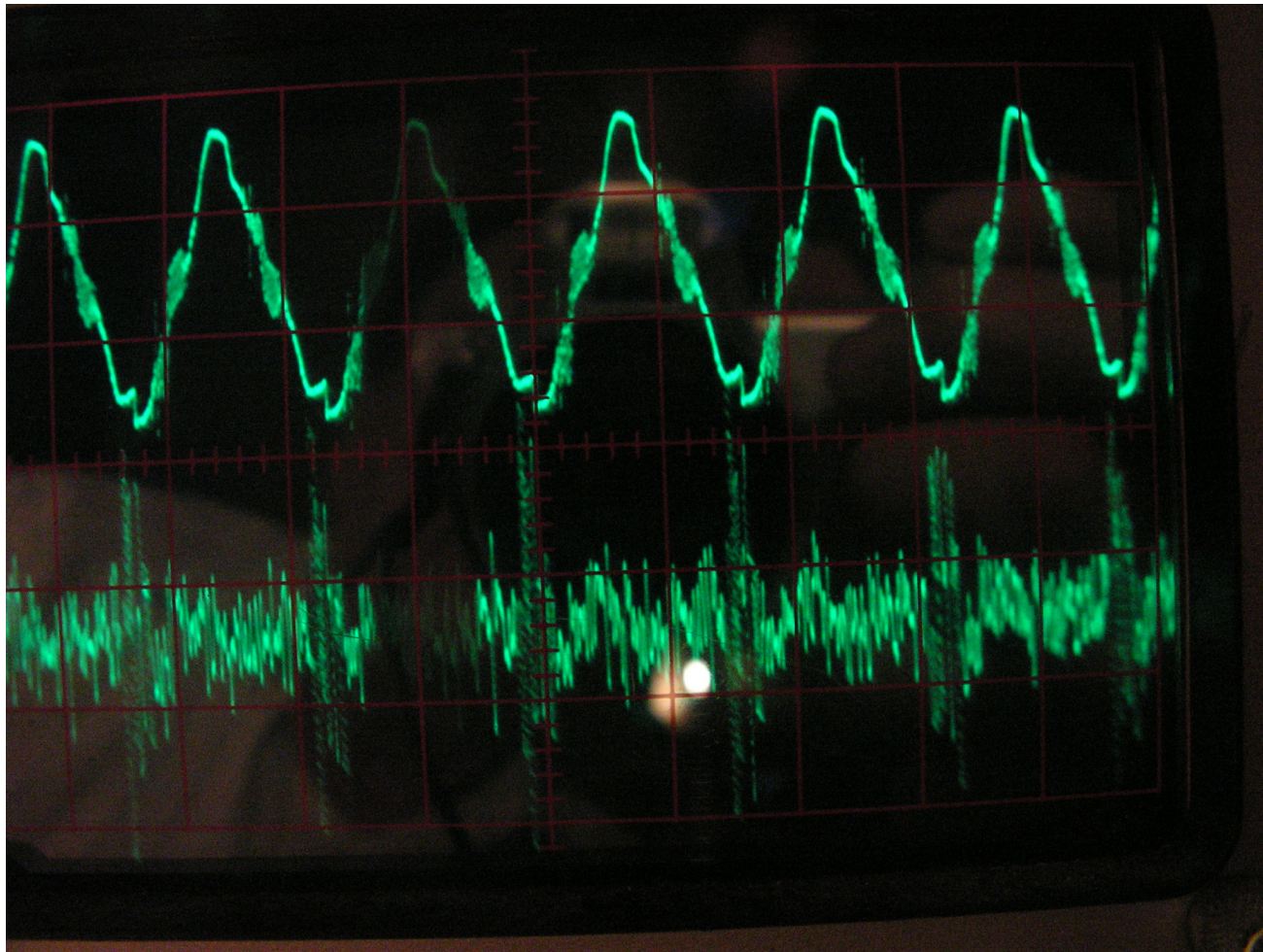




# Scope display-120Hz noise

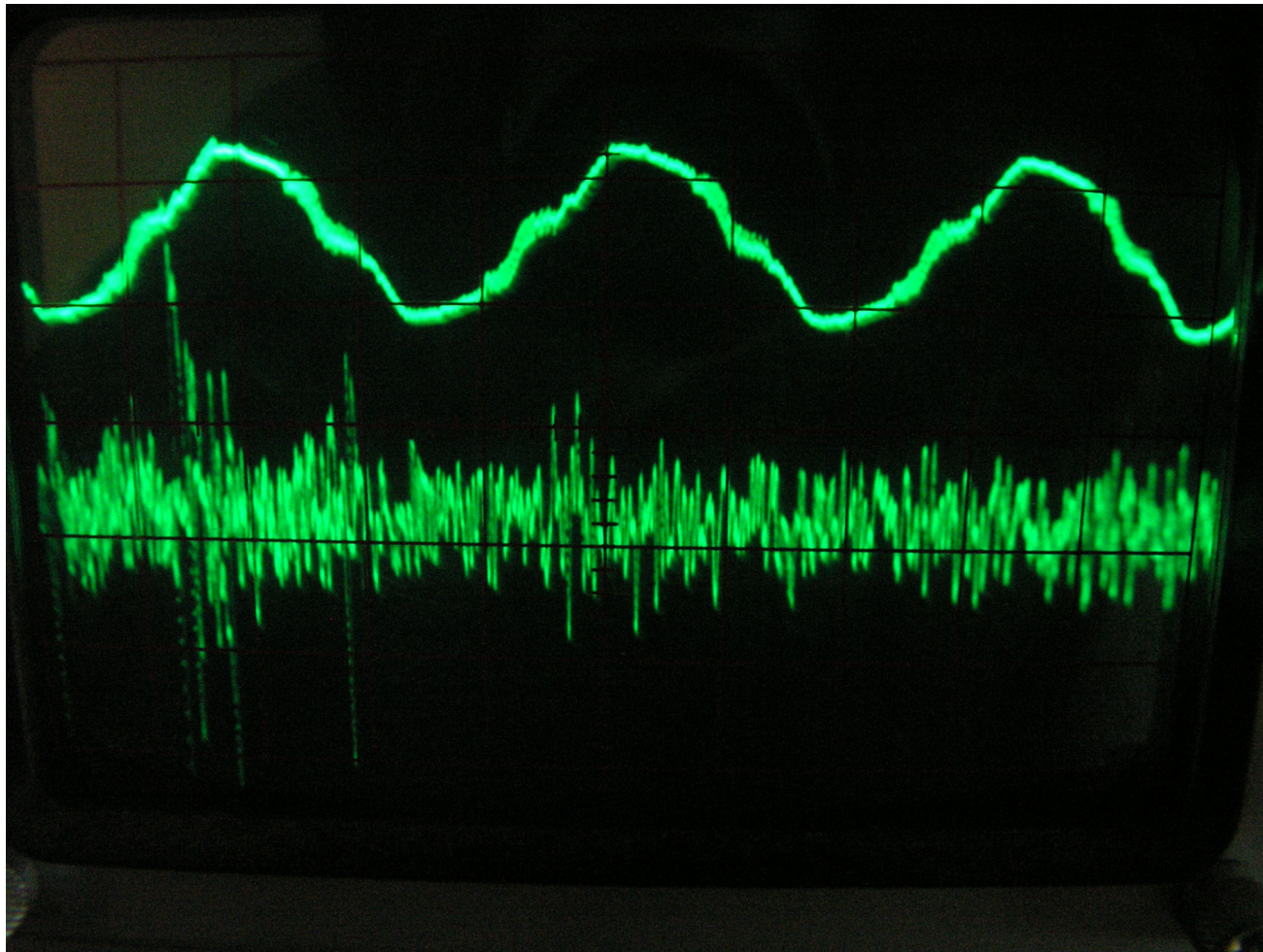


# Scope Display-60Hz noise





# Scope display-intermittent



# Spectrum Display





## 60Hz vs 120Hz

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- Noise spikes are synchronous with powerline peaks-sync scope on 60Hz powerline
- 120Hz indicates sparking on both positive and negative peak
- 60Hz indicates sparking on only one peak
- Intermittent indicates just barely sparking
- Let's try it!





# Take data before you email

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- My powerline noise problem was VERY intermittent
- May 5 (Sat.) interf started midday; 75 deg hi; noise off in eve
- May 6 (Sun.) no interference whenever checked
- May 7 (Mon.) ground wet in AM; 68 deg hi; sunny in PM; no interference whenever checked
- May 8 (Tues.) sunny all day; 75 deg hi; no interference whenever checked
- May 9 (Wed.) sunny and dry; 83 deg hi; no interference whenever checked
- May 10 (Thurs) foggy; 80 deg hi; no interference when checked



# Ultrasonic Detector

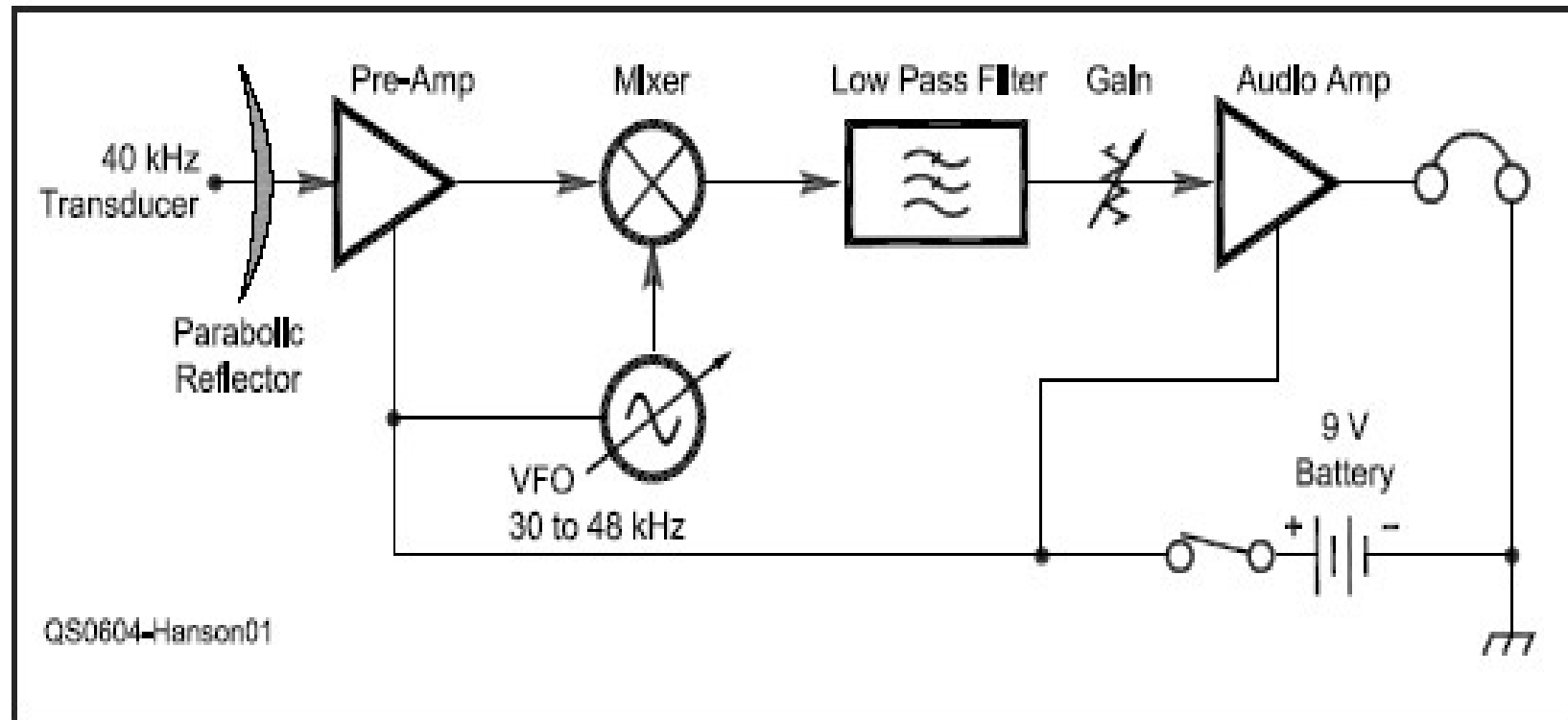
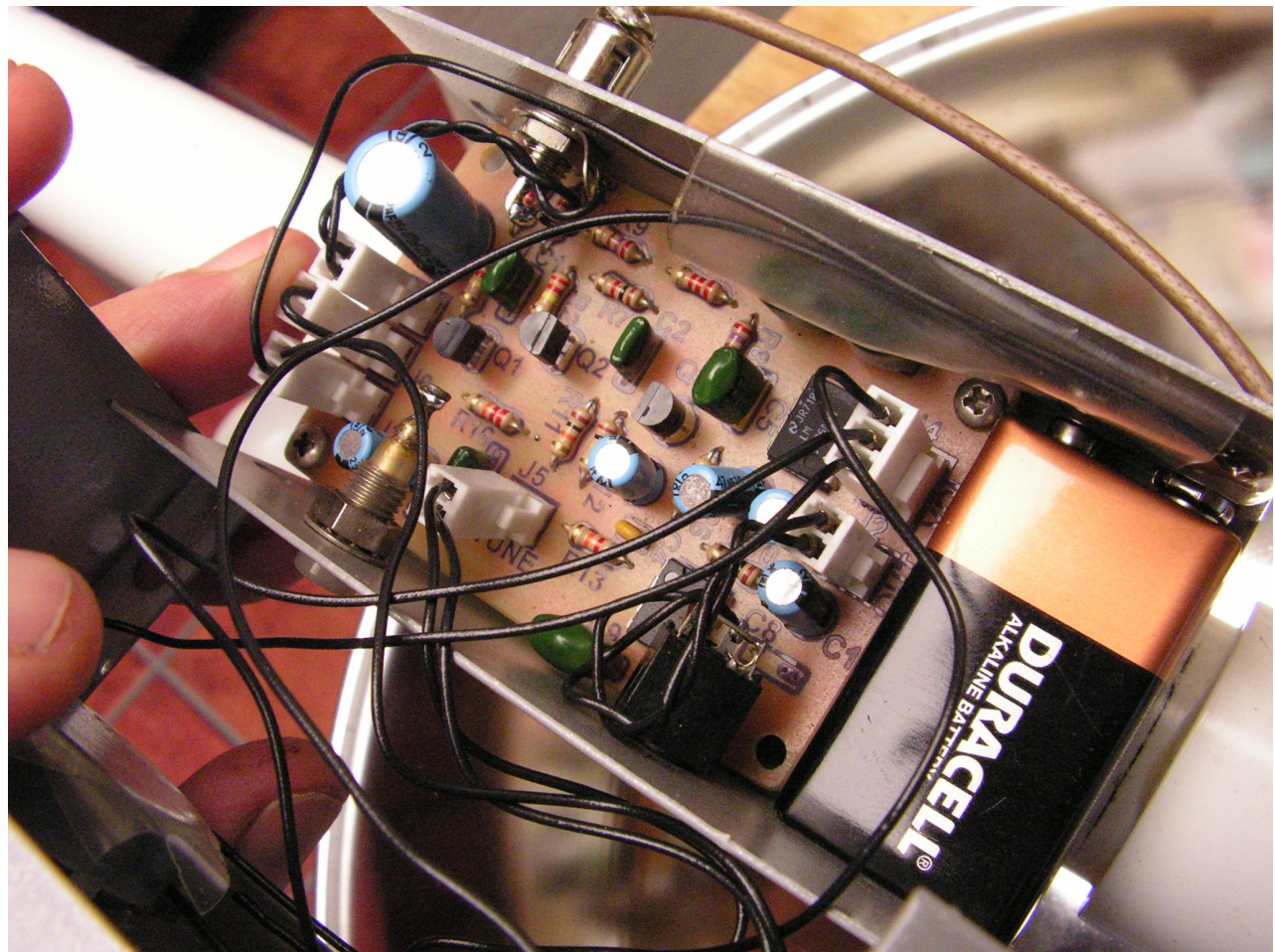


Figure 1 — Simplified block diagram of the ultrasonic detector.

# Ultrasonic Detector





# Ultrasonic Detector

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- From QST – cost me about \$90 with NO junkbox parts-dish alone was \$42
- Can locate EXACT location of noise source on power pole
- Fun to play with - insects in summer, bats, ultrasonic sources other than powerlines
- Let's try it!



# Work on pole 14





# Work on pole 14



# Work on pole 7





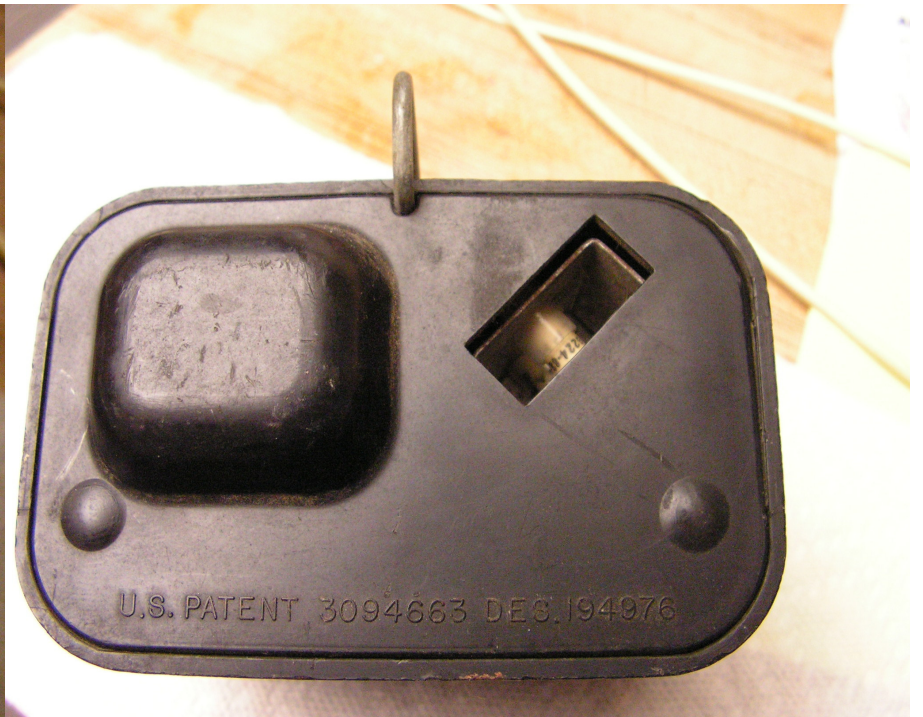


# Results

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- LIPA crews came 3 times for repairs
- Took about 3.5 months
- Sent & received about 25 emails
- Better if YOU can provide data/measurements because of BIG number of complaints (1500-2000/yr)
- LIPA contact is a ham

# Another interesting detector



# “Radar” detector

