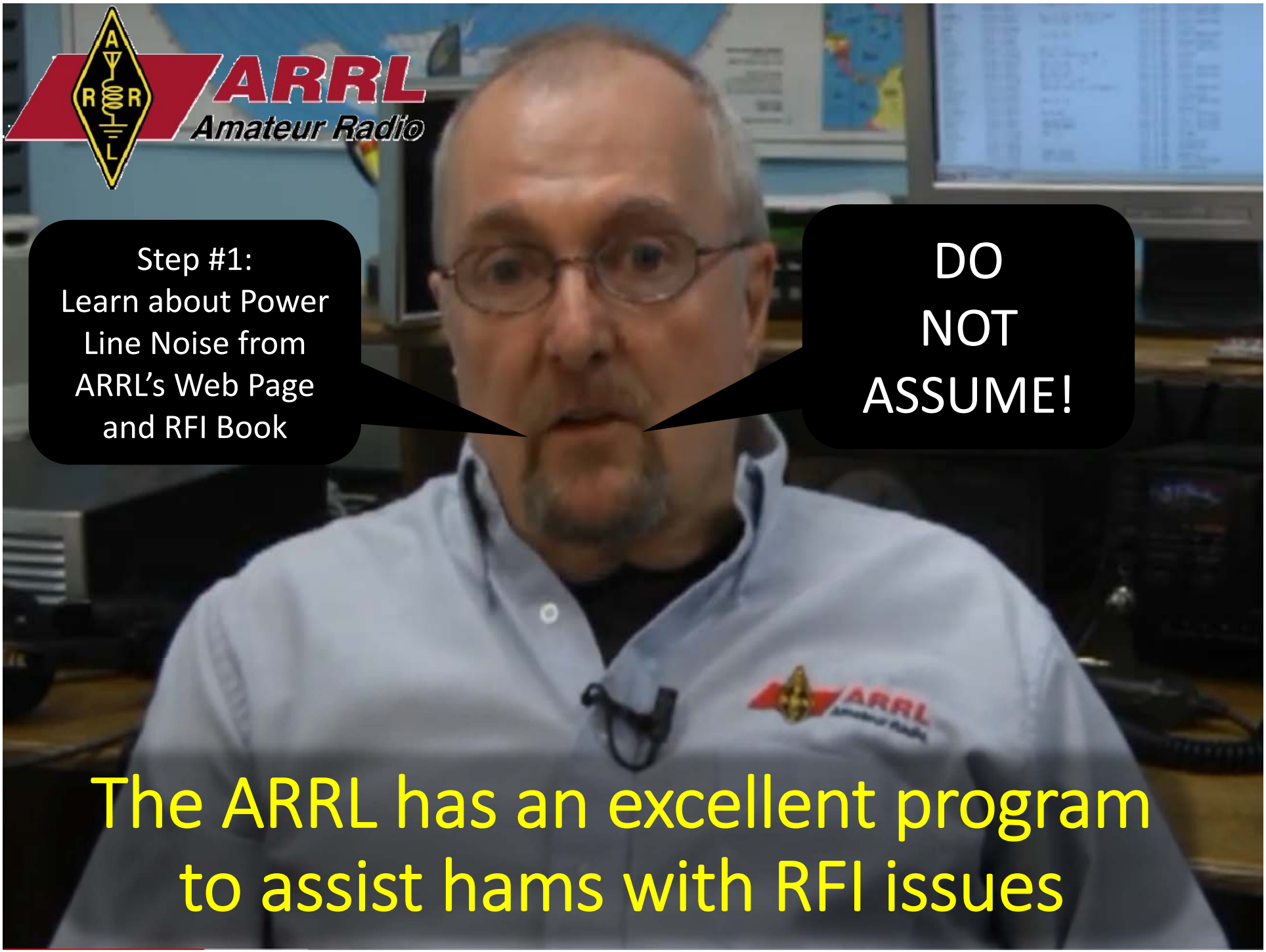
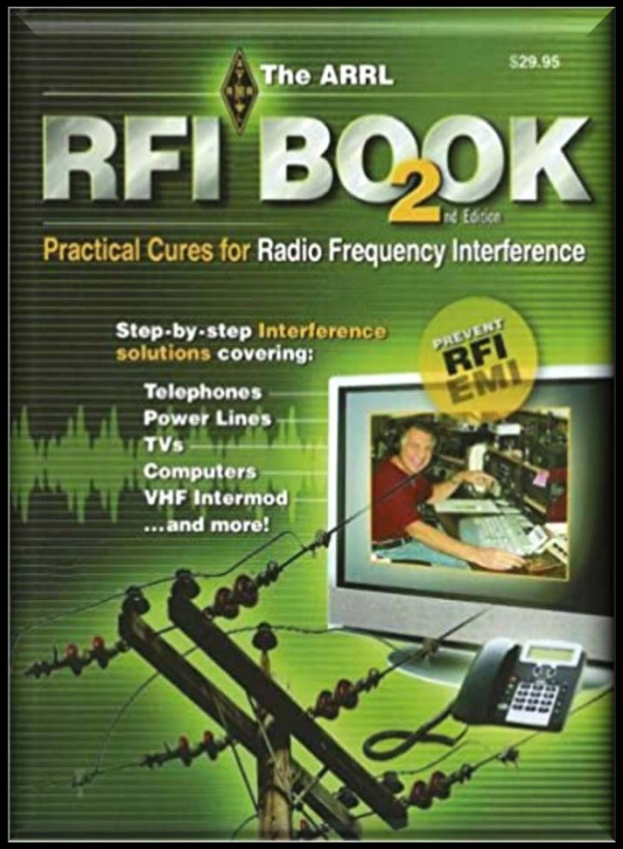

Locating & Resolving
HF Radio Interference
Power Line Noise

How To Get Rid of HF Interference Issues

Although the problem has been around since the dawn of radio communications and broadcasting,

POWER LINE NOISE IS ON THE RISE


ARRL
Amateur Radio
Step #1:
Learn about Power Line Noise from ARRL's Web Page and RFI Book
DO NOT ASSUME!
The ARRL has an excellent program to assist hams with RFI issues



Locate the source of the power line interference using appropriate measures

Document your findings substantiating your Issue & the noise source involved

Notify the Utility with supportive documentation

Work with the Utility as needed to fully resolve the issue

Up front work will go a LONG
way in expediting resolution

The Protection Against Interference

FCC Rules & Regulations

Dear Mr. McClanahan:

The Federal Communications Commission has received complaints that equipment operated by your utility may be causing harmful radio interference to an operator in the Amateur Radio Service. The complainant is:

(name withheld)

(address withheld)

The FCC has the responsibility to require that utility companies rectify such problems within a reasonable time if the interference is caused by faulty power utility equipment. Under FCC rules, most power-line and related equipment is classified as an "incidental radiator." This term is used to describe equipment that does not intentionally generate any radio-frequency energy, but that may create such energy as an incidental part of its intended operation.

Please advise the complainant what steps your utility company is taking to correct this reported interference problem. The FCC expects that most cases can be resolved within 60 days of the time they are first reported to the utility company. If you are unable to resolve this by June 30, 2009, please advise this office about the nature of the problem, the steps you are taking to resolve it and the estimated time in which those steps can be accomplished.

If you have any questions about this matter, please contact me at 717-338-2577. Thank you for your cooperation.

Sincerely,

Laura L. Smith, Esq.

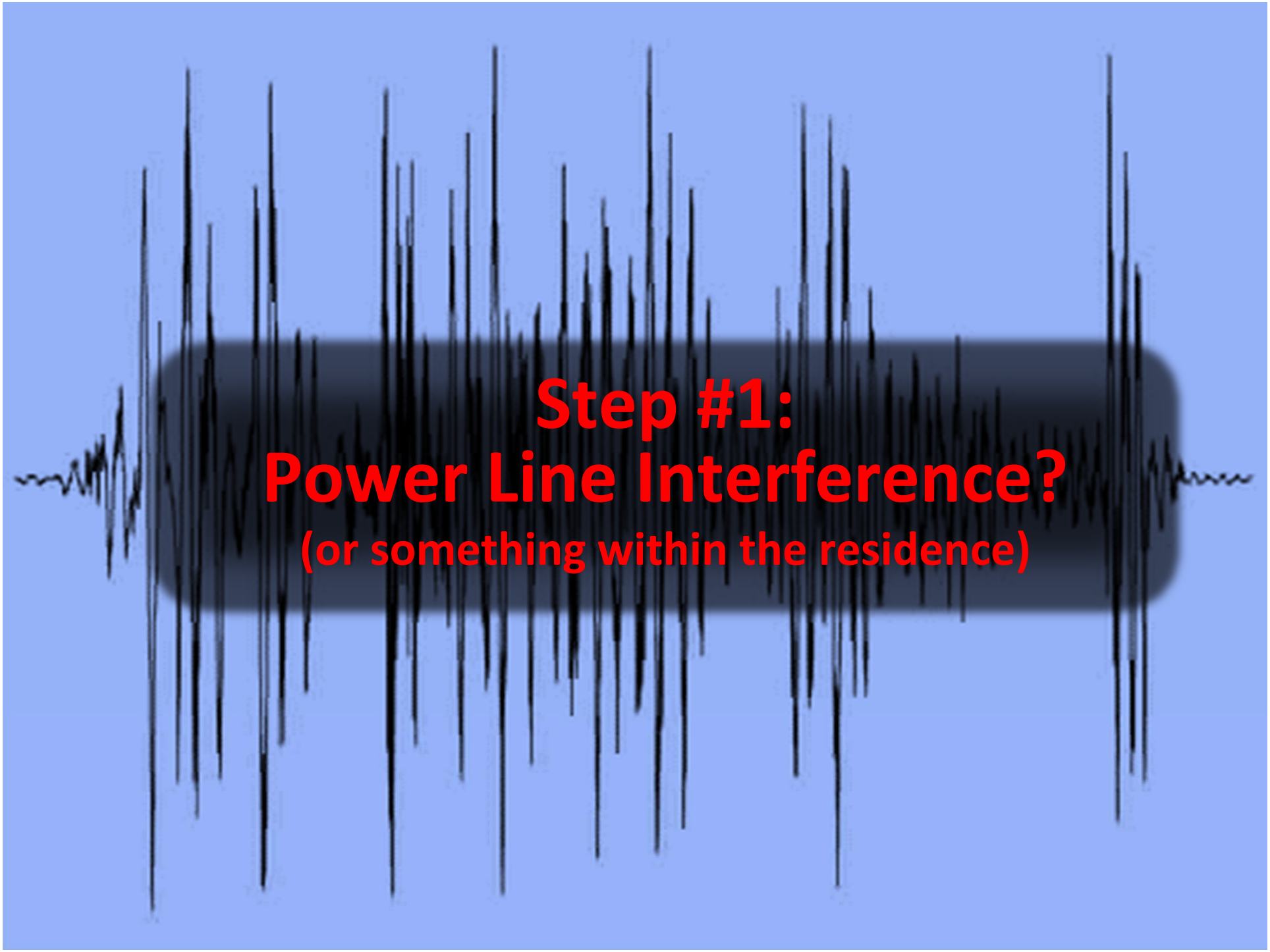
Special Counsel, Northeast Region

Enforcement Bureau

cc: FCC Regional Director

The FCC **WILL** become involved if needed

Typically with assistance through the ARRL


Step #1:
Power Line Interference?
(or something within the residence)

1) **Verify presence of noise** using a portable radio while at the main breaker

2) **Shut off power** to the residence

3) **If the noise stops** the source is within the residence.
   - Turn off breakers one by one to isolate

4) **If the noise continues** it is coming from an external source

Repeat this process at closest neighbors if possible

Home Items That Could Cause Noise / Interference

- **Door Bell Transformers**
- **Electric Blankets**
- **Recessed Light Fixtures**
- **Refrigerators**
- **Light Dimmers**
- **Battery Chargers**

If these devices causing harmful interference they are in violation of Federal Communications Commission rules and regulations

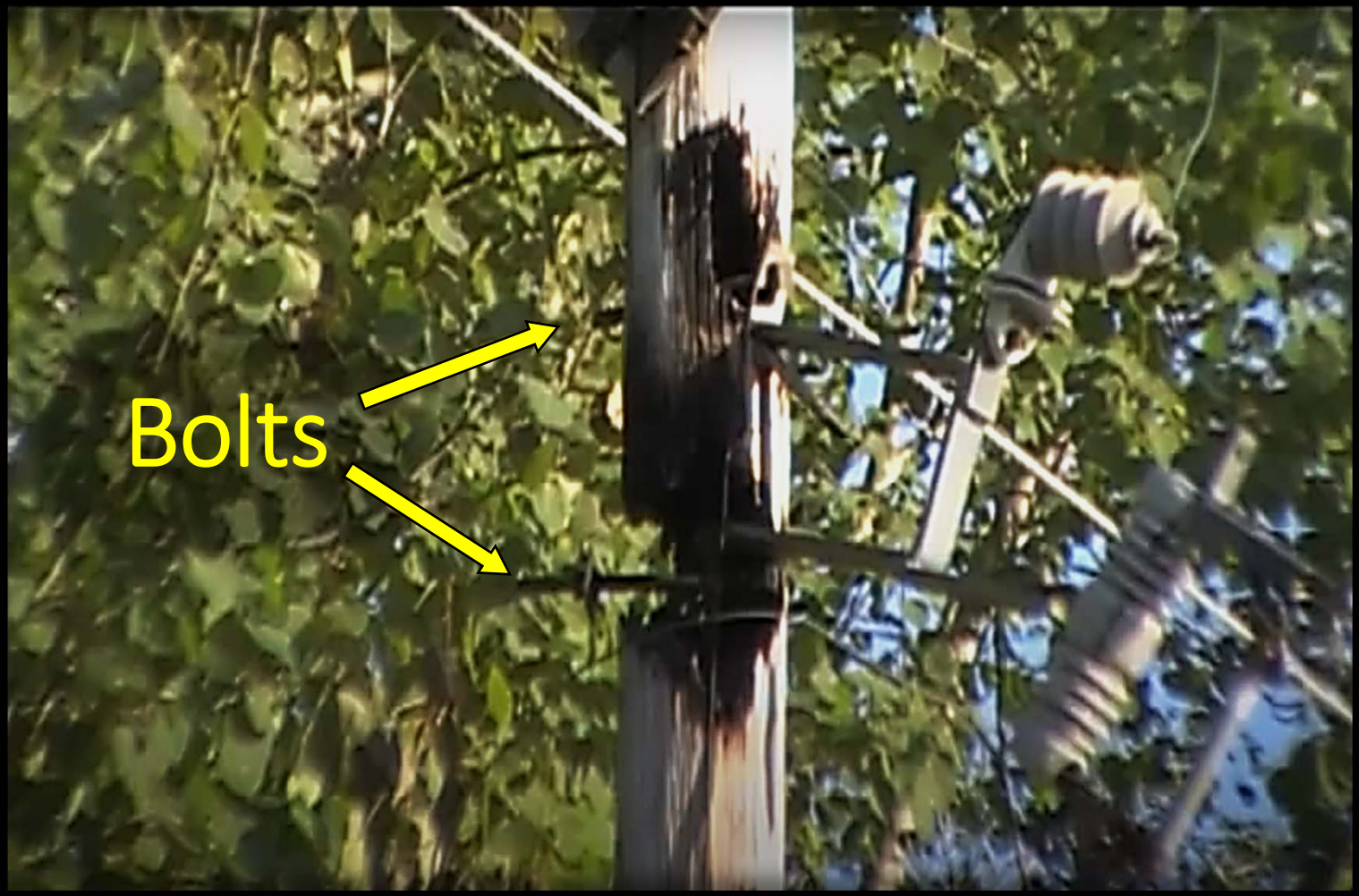
Home Items That Could Cause Noise / Interference

- Noise that varies with the time of day **is related to what people are doing, usually pointing to some electrical device or appliance.**
- Noise from consumer type devices **will often come and go with periods of human activity and frequently correlate with evenings and weekends.**

What Causes Power Line Noise

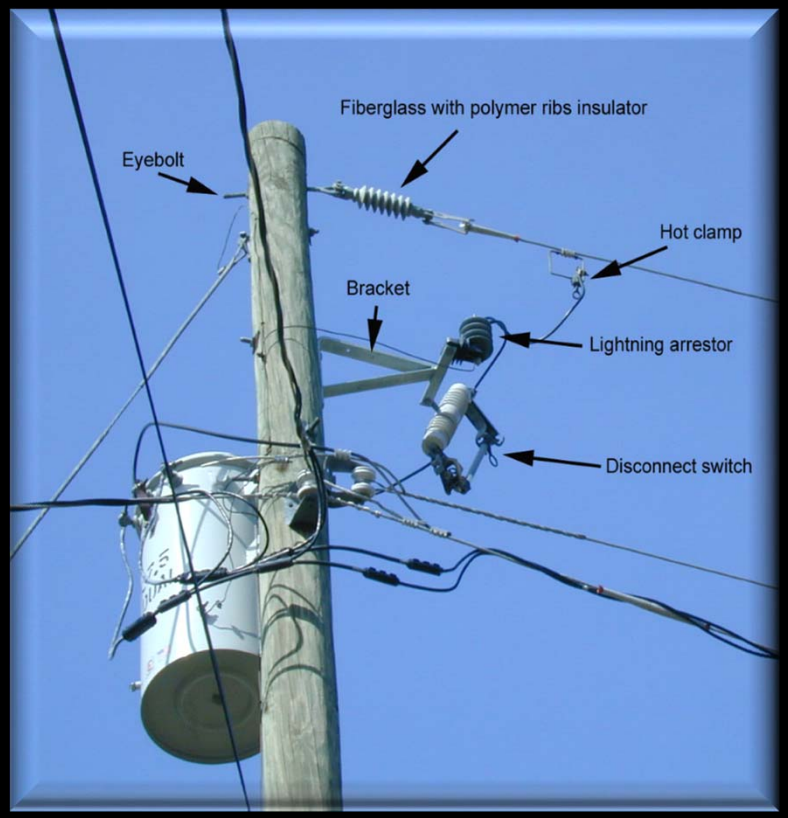
Power Line Noise: The Cause

- Virtually all power-line noise is caused by a spark or arcing across power-line related hardware.
- A breakdown and ionization of air occurs, and current flows between two conductors in a gap.
- The gap may be caused by broken, improperly installed or loose hardware.
- *Tends to go away in wet weather*



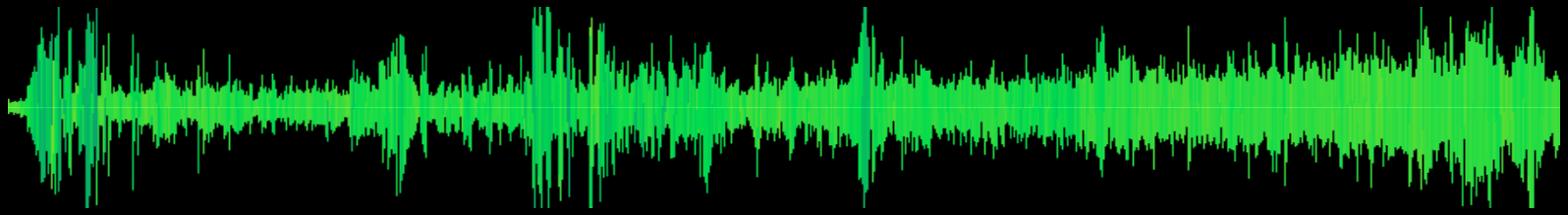
Many Power Lines Generate RFI Before They Fail!

Power Line Noise: Typical Sources



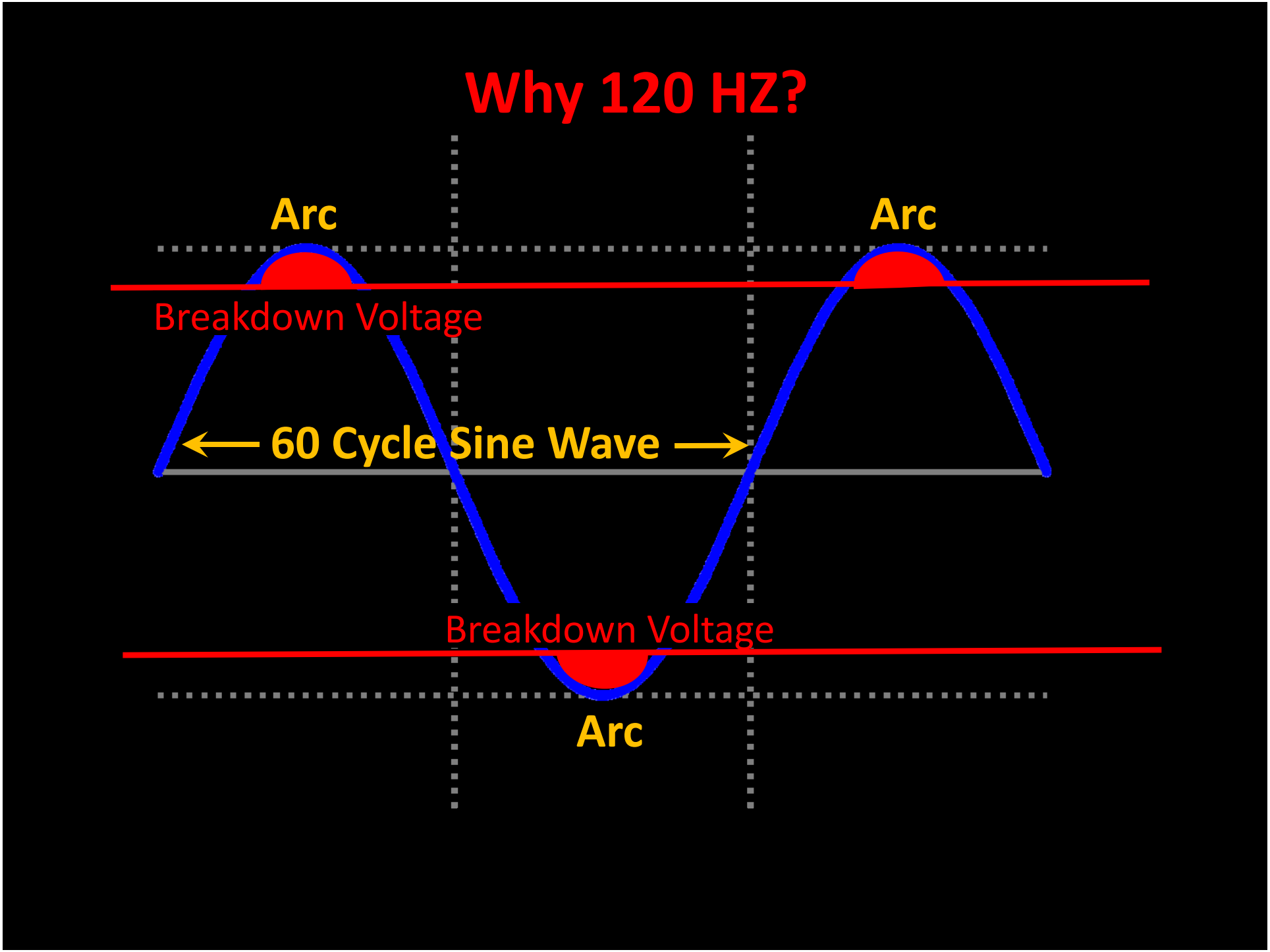
- **Loose Hardware**
- Faulty Lightning Arrestor
- Loose Pole Top Pin
- Intermittent Tie Wire
- Corroded Slack Span Insulators
- Guy Touching Neutral

Power Line Noise: The Characteristics

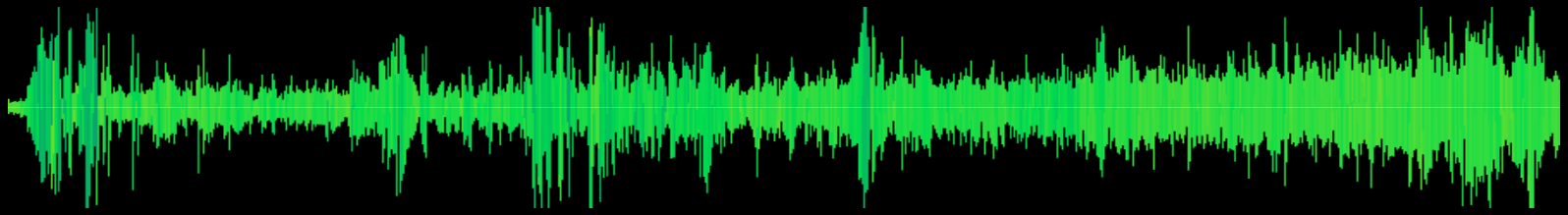


- Periodicity of 120 Hz (Spark Time Domain)
- Broadband spectrum (Spark Frequency Domain)
- Conducted and/or radiated
- Normally stronger at HF (detect miles away)
- Usually weaker at VHF (detect meters away)

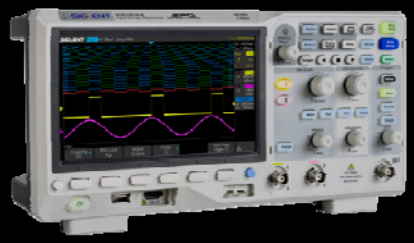
Example 1 **Example 2**


Why 120 HZ?
Arc
Arc
Breakdown Voltage
60 Cycle Sine Wave
Breakdown Voltage
Arc

Gather the Facts



- Is the noise present all the time?
- Goes away during rain or high humidity?
- Spectrum repeats every 40 KHz to 60 KHz?
- <u>Noise does NOT go away when main breaker pulled</u>



Scope It!

DOCUMENT THE NOISE SIGNATURE!

Record It!

Locating the Power Line Noise

Locating Power Line Noise: Three Methods

Portable receiver (AM mode)

(such as R&S PR-100 DDF) with directional antenna – typical starting point

- AM Broadcast Band + HF + VHF/UHF
- Many HT's cover aircraft band (VHF/AM)

Portable ultrasonic receiver

(such as MFJ-5008) can be used to isolate source – typical closing step to detected 40 KHz spark signature

Lineman Hot Stick (such as Radar Engineers model 247) to isolate source to component on pole – typical final step

- Includes RF and Ultrasonic

WB9LIB's Equipment

Portable
HF
(Initial)

Radio Shack 20-315
VHF/UHF Scanner
With
MFJ-762 Attenuator

Arrow 121.5-3
Hand Held Yagi

Radio Direction Finding

- **Beginning at the QTH**
  directionalize the source of noise
- **Use the Highest Frequency**
  on which the noise can be heard (VHF/UHF preferable)
- **Stay out from underneath**
  the power lines while tracking

Related Factors:

- Noise can be propagated and radiated along power lines
- At HF frequencies, noise can be conducted for several miles.
- At VHF, conducted propagation is limited to several hundred meters.

Follow the Signature
(same as what power company would do)

Do NOT be mislead tracking unrelated noise!

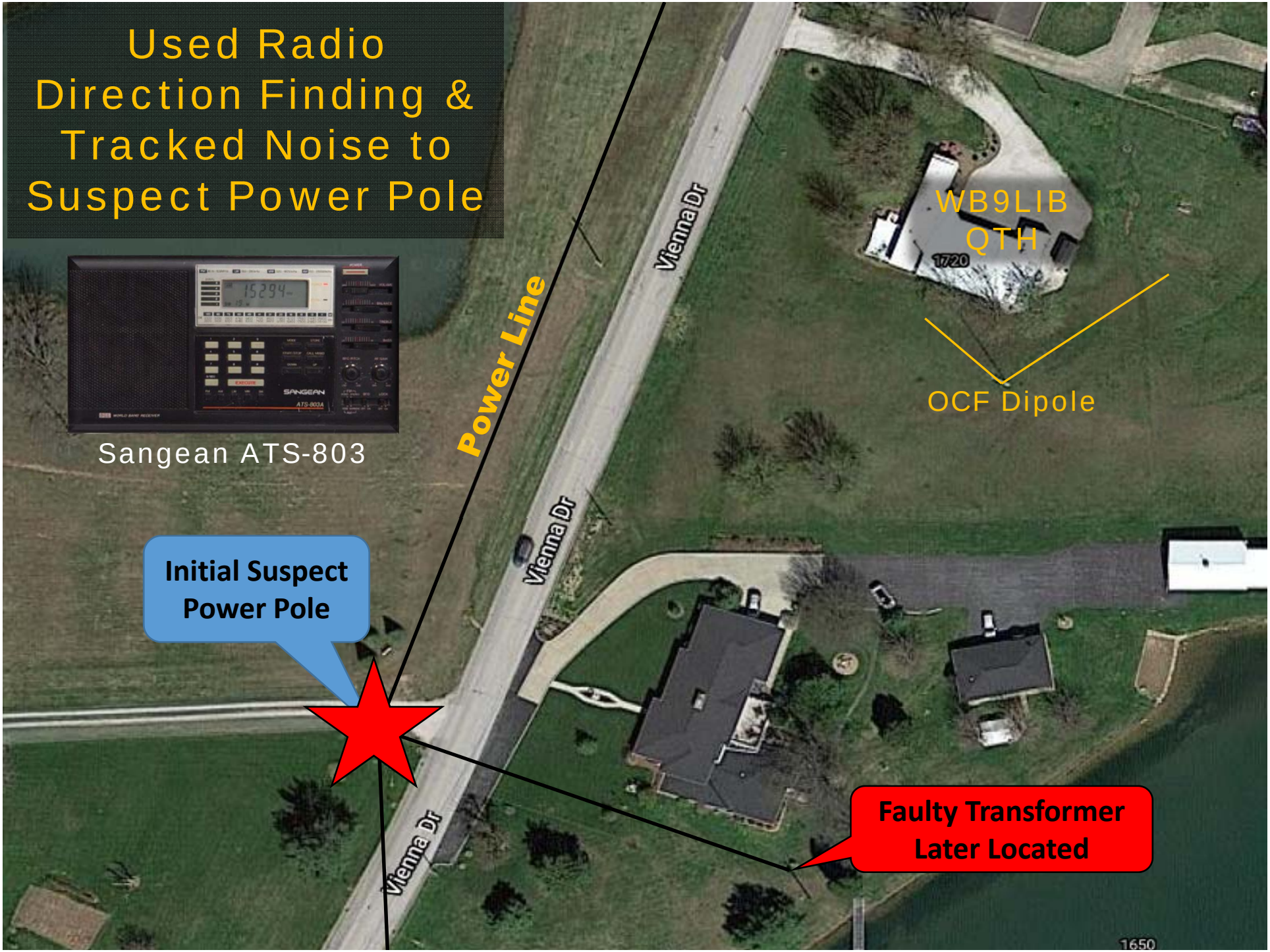
Stick with the ACTUAL problem source

Successful Noise Source Located
Using 440 MHz Radio Direction Finding

My Recent Bout With HF Noise

Used Radio Direction Finding & Tracked Noise to Suspect Power Pole

Sangean ATS-803



NOTIFICATION: Dubois REC Power Line Interference

Background: For the past month, electrical interference has been intermittently emanating from the Dubois County REC power grid near 1660 Vienna Drive in Ferdinand. When the interference is present, it impedes operation of a nearby radio station at 1720.5 Vienna Drive by FCC licensed amateur radio operator Gary Fritz (WB9LIB). The interference spans from the AM broadcast band up to approximately 10 MHz. The noise is sometimes present for days, then disappears for a week or more, but typically returns again at a later date.

When the noise is at its worse, driving up and down the road with a vehicle's AM radio tuned to 1710 KHz easily reveals the noise source as a roaring sound near the suspect power pole. A hand-held AM radio held near the pole or its guy wires reveals the same.

If the noise persists over the next day, I my request a visit from Dubois REC to investigate. ***My hand-held AM radio provides excellent service as a noise detector and roars whenever it is held close to the noise source.***

Thanks,
Gary Fritz
August 3, 2021

SPECTRUM WHEN NOISE IS NOT PRESENT as measured with a radio receiver located at 1720.5 Vienna Drive. The spectrum appears clean above the AM broadcast band.

Included in Notice to Dubois REC

Noise Signature

SPECTRUM WHEN NOISE IS PRESENT as measured with same radio receiver. Not the wide-band noise whose spectrum appears just above the AM broadcase band. This noise extends well into the short-wave band interfering with my radio communications.

Audio Clip

RF Interference Resolved

On August 4, 2021

- Dubois REC arrived & investigated
- Isolating noise to neighbor's transformer (using my portable RF sniffer)
- Pulled neighbor's main breaker & noise still present
- Transformer replaced & pole hardware serviced

THE NOISE WAS GONE FROM MY HF RADIO!!!!!

When All Else Fails:

Main Antenna

Reference Antenna

The MFJ-1026 Noise Canceller / Enhancer

(1.8 – 30 MHz)

The MFJ-1026 reduce noises or interference, or enhances signals via phase control. Unlike conventional noise reducers, the MFJ-1026 can be effective on ALL types of noise, including interference (QRM) from unwanted signals

Resolving HF Power Line Noise Issues

The process to effectively locate & resolve power line noise.

Gary Fritz, WB9LIB

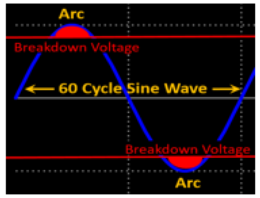
While the problem has been around since the dawn of radio communications, ***power line noise is on the rise***. Almost every amateur radio operator has, at some point, been confronted with the all-too-familiar raspy buzz that can disrupt radio communications, particularly on HF.

Note: Always exercise appropriate safety measures while engaged in locating and resolving power line noise issues to avoid accident or injury. Should you decide to proceed with this activity do so at your own risk.

Fortunately, many amateur radio operators already have the equipment which can be used to locate & identify the noise source. Sometimes an AM radio combined with an HT able to tune AM on Aircraft Band (VHF), 2M, or 70cm may be all that is needed.

A portable short wave radio and Yagi for your HT are **very** helpful.

Virtually all power line noise originating from utility company equipment is caused by arcing across loose or defective hardware. A spark-gap transmitter is, in effect, created with the high voltage discharge generating RF across the resonant spectrum of the conductors.



The resulting noise bursts repeat at 120 Hz, since the voltage breakdowns occur twice during each 60 Hz power cycle. The resulting radio frequency interference (RFI) may span the AM broadcast band to 30 MHz or beyond at various levels. In some cases the interference may only be detectable across portions of the HF spectrum.

Loose hardware is a very common cause of power line noise along with faulty insulators, lightning arresters, or other hardware defects. Transformers are less likely the issue.

FCC Rules Apply

FCC Part 15 protects licensed radio services including amateur radio from harmful interference, and, **that includes power line noise**. The FCC generally allows 60 days for a utility to resolve interference issues after notification. But, the noise source must first be identified to determine who is at fault. *That's where up front work by the amateur radio operator can pay off.*

Important First Step

Safely turn off the main breaker to your residence while listening to the noise on your HF radio operating on battery backup, or, while using a portable radio. ***If the noise stops, then the source is within your residence*** and it is up to you to resolve it.

It would be helpful if the same check could safely be performed at the closest neighbors to eliminate those locations as potential noise sources. *Use caution along with your best judgement if you decide to pursue this avenue as there may be risk involved.*

The ARRL can write a letter to a neighbor on your behalf, if a noncompliant device is causing harmful radio interference as defined under FCC Parts 15 or 18. *The operator of the faulty device is responsible for resolving the issue.*

New Application Note

PATOKA VALLEY AMATEUR RADIO CLUB

Posted on PVARC Web Site


Thank You