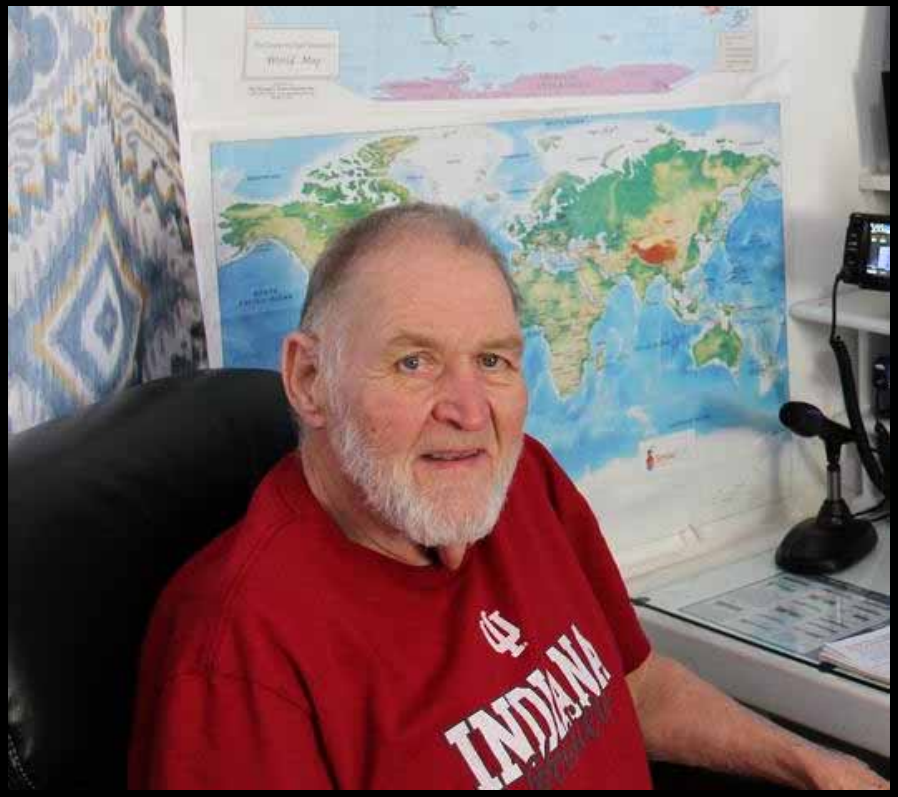

Resolving RF Interference
at KC9NKI's Station

Agenda

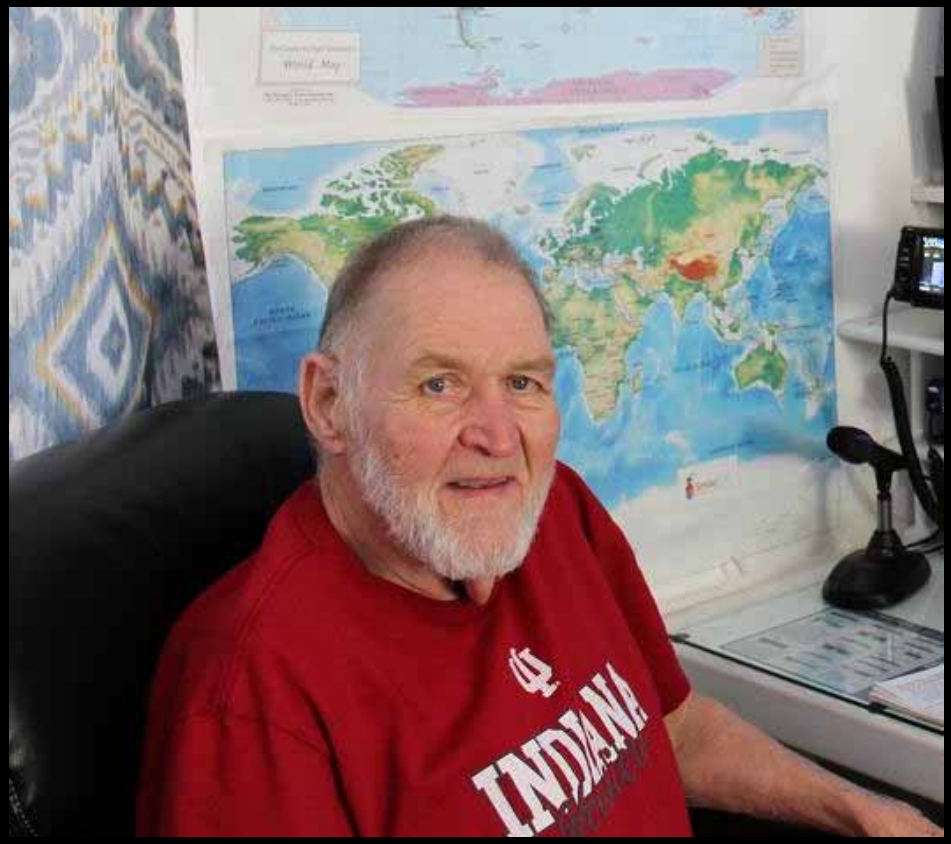
- When RF Interference Started
- Amateur Radio Bands Affected
- Identifying the Noise Signature
- Tracking the Noise to the Source
- Resolving the Interference Issue

Understand the Process of Detecting & Eliminating EMI/RFI

Interference Initiation



On August 12, 2023, KC9NKI initially reported HF noise was seriously degrading his amateur radio HF operations



KC9NKI PUT OUT A CALL FOR HELP!

The PVARC Team Responded

WB9LIB

N9NAU

KD9KNB

Patoka Valley Amateur Radio Club

Hams Helping Hams!

WB9LIB's Initial Assessment

WB9LIB's Initial Assessment
(August 12, 2023)

KC9NKI's Station

- Initial testing revealed the noise was wide-band (likely digital)
- Spanned 2 MHz to 15 MHz
- 40M was the most seriously impacted HF band

The terrible noise was present on both his Yaesu FT-DX10 and Yaesu FT-991A

Step #1

Determine whether the noise is originating within the residence

Removing Power from Residence

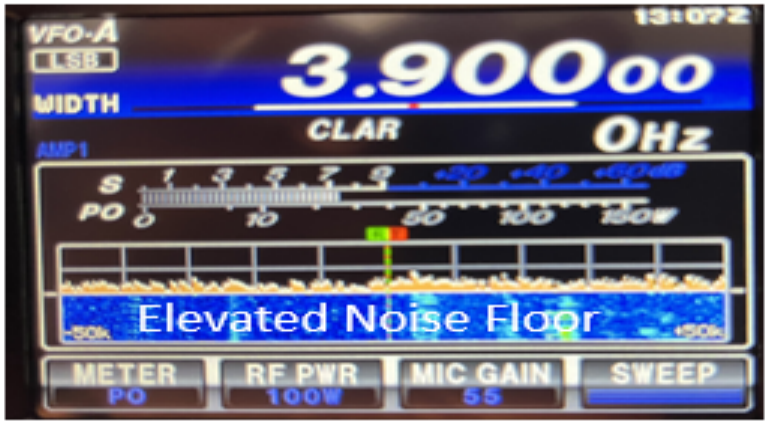
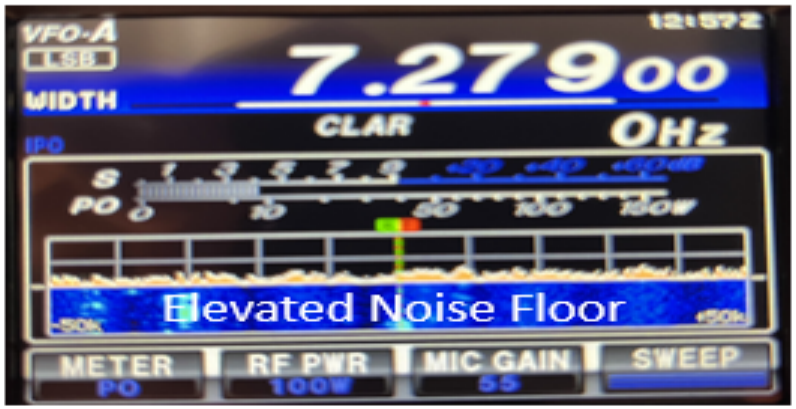
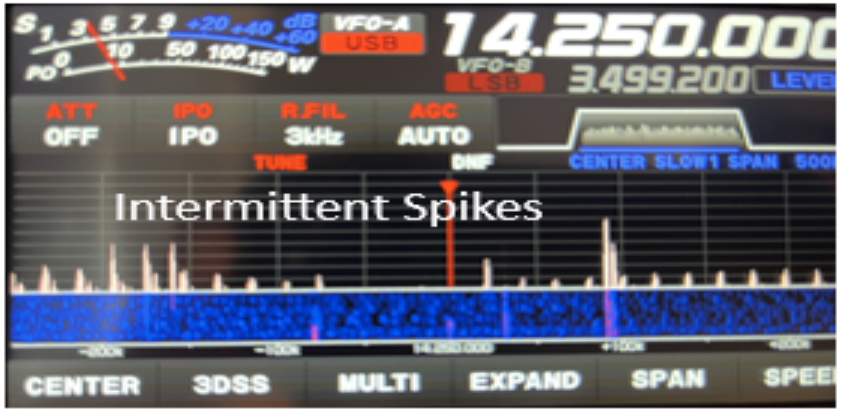
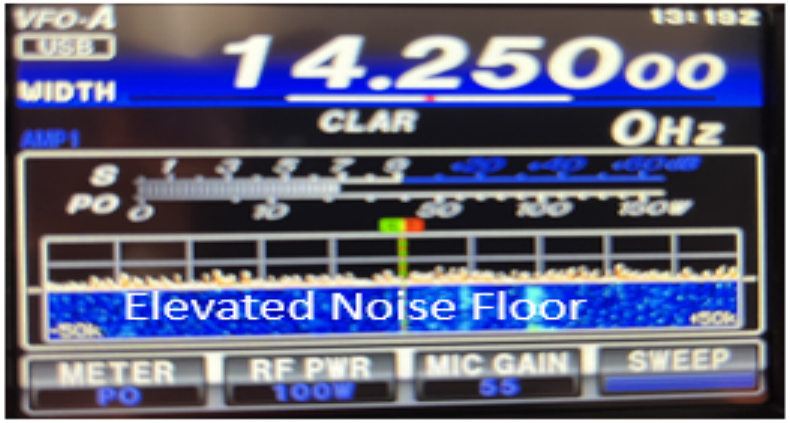
- On August 12, 2023 the power main was shut off to KC9NKI's residence
- This had no effect on the noise, as perceived via a Sangean ATS-803 connected to the Comet CHA 250B

- *The noise was originating off-site*

Step #2

Documenting the HF noise signature


• There can be multitudes of noise sources across an area
• We need to locate the one causing the problem!

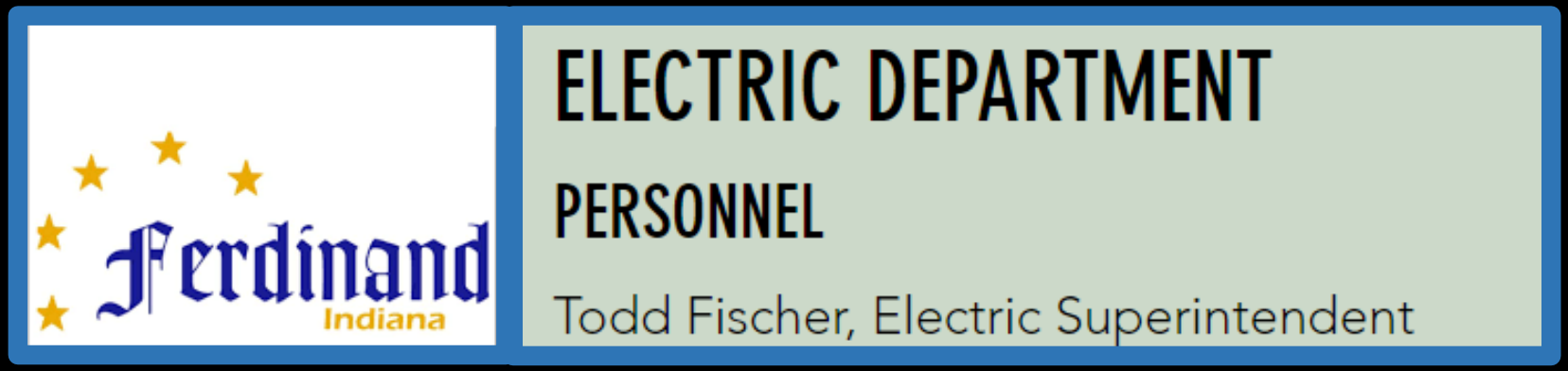
	FT-DX10	FT-991A
80M **(3900 KHz)**		
	S-4	**S-7**
40M **(7279 KHz)** **NOISE MOST NOTICEABLE ON THIS BAND**		
	S-6 to S9	**S-4**
20M **(14250 KHz)**		
	S-4	**S-7**

Step #3

Drive around the neighborhood looking for any obvious sources of HF noise


Potential 8 MHz noise source @ 16’th Street and Virginia Street (Power Pole)
Driving route taken Aug 14 with mobile HF radio
KC9NKI QTH
MISSOURI ST
TUCKY ST
SIXTEENTH ST
Ferdinand
162
64
11/05/2003

Ferdinand Electric Department



FERDINAND UTILITY ASSISTED on the morning of August 16, 2023:

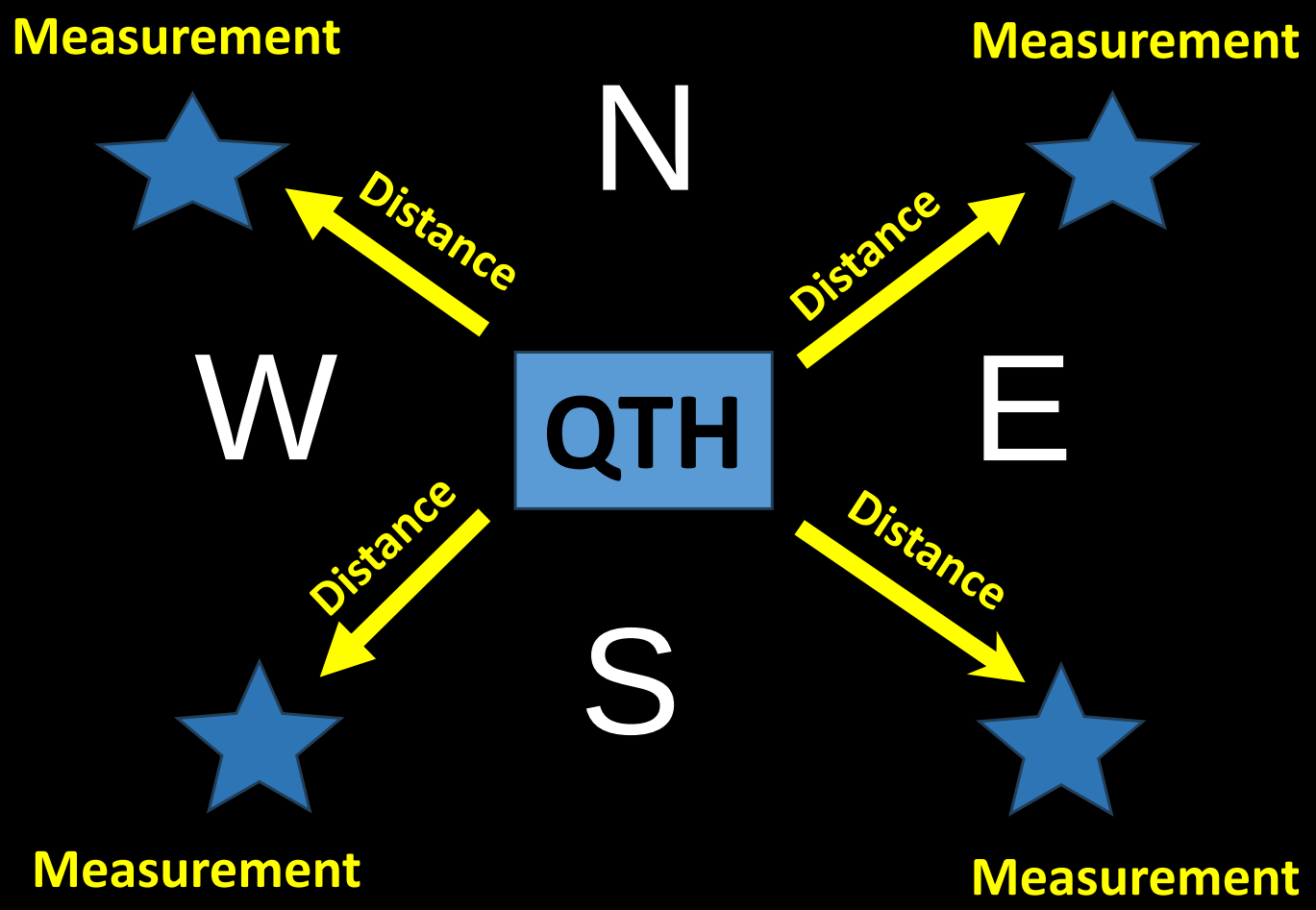
- They inspected the power pole at 16'th & Virginia & tightened hardware on that and nearby poles
- **This unfortunately had no effect on the noise,** as received by KC9NKI's FT-DX10

Step #4

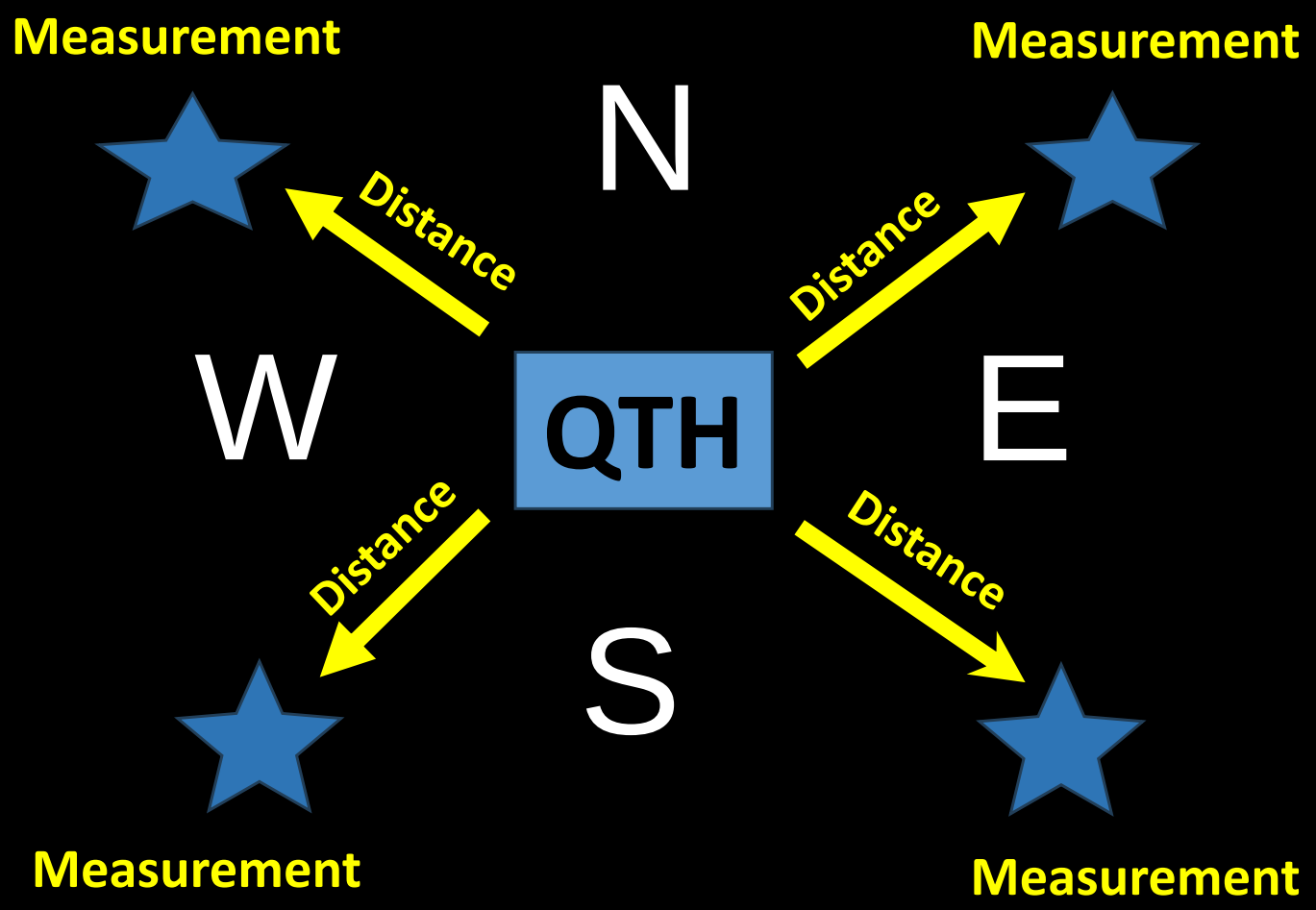
Identify what direction the noise was coming from

KD9KNB and N9NAU joined the team to assist

This effort was based on the inverse-square law where RF signal strength decreases with the square of distance.

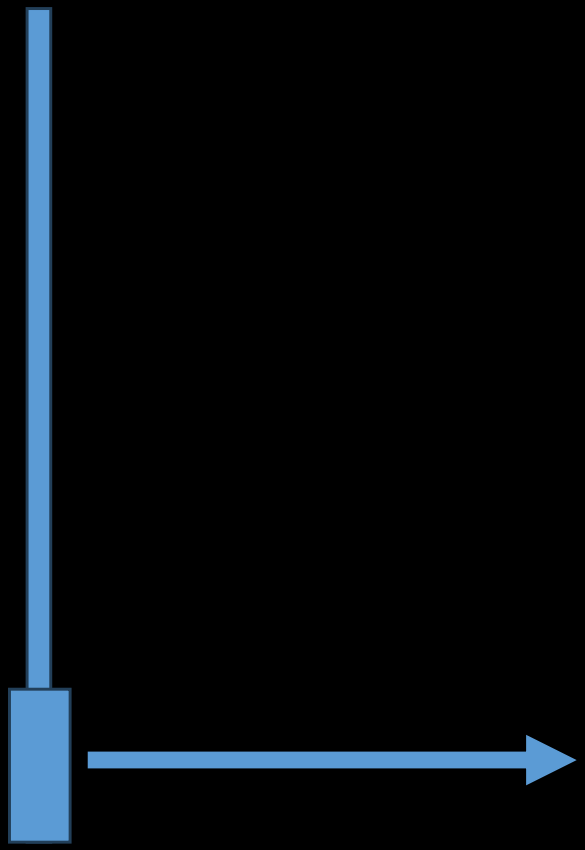


If we get closer to the noise source, we would see a SIGNIFICANT difference in signal strength during this test.



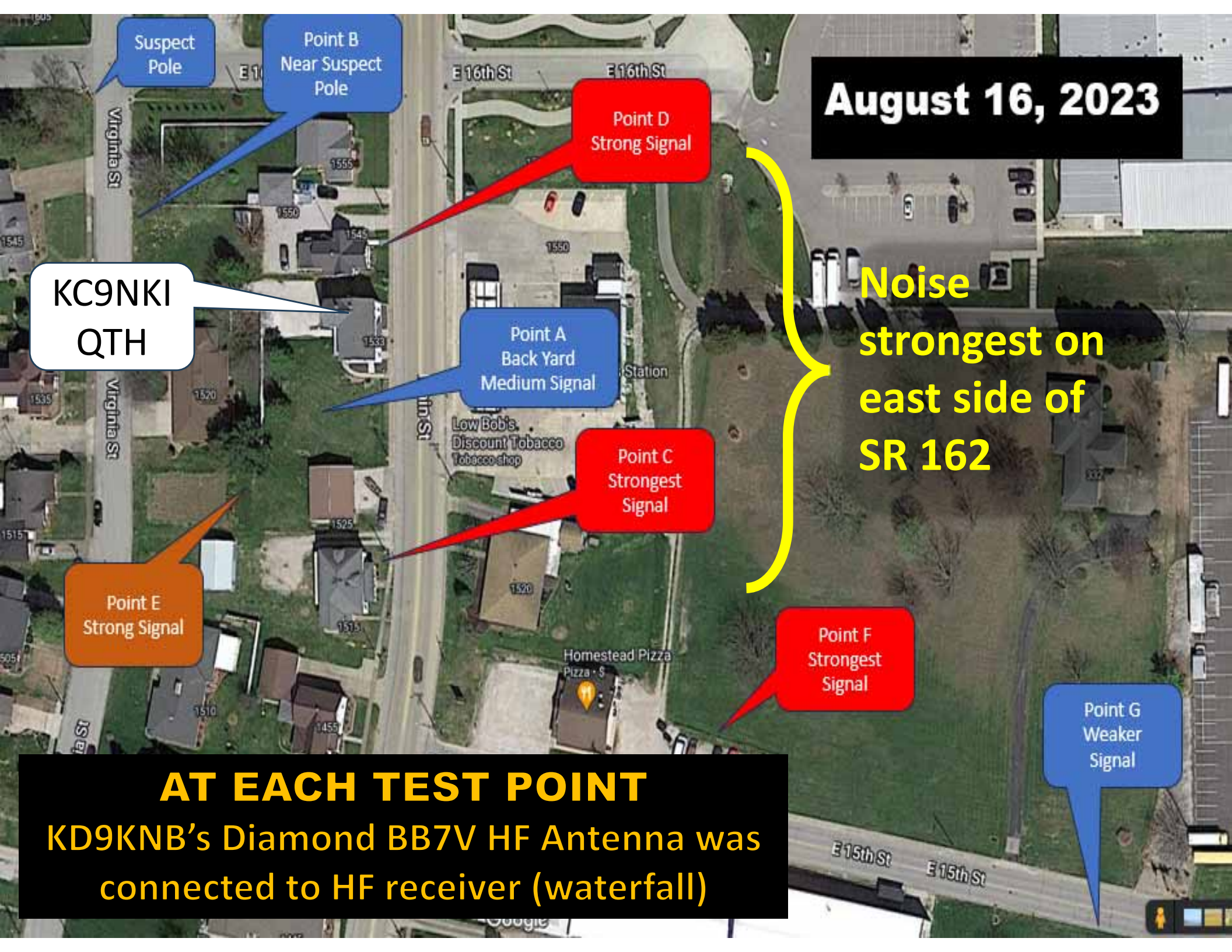
If we cut the distance in half, we get 4 times the signal strength (close to an S-unit)

Portable Test Setup



Diamond BB7V
HF Antenna
(Portable)

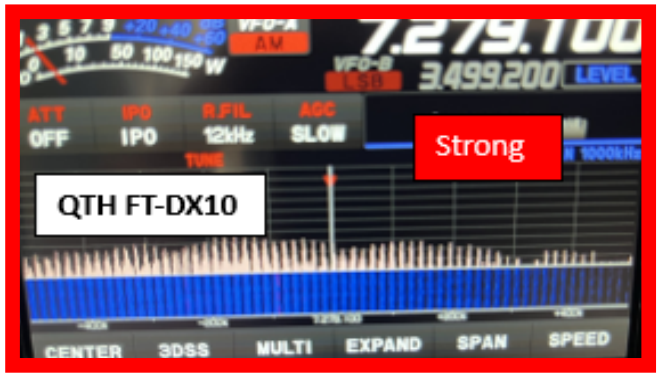
HF Transceiver
FT-DX10 (KC9NKI QTH)
FT-991A (KD9KNB)


Suspect Pole
Point B Near Suspect Pole
Point D Strong Signal
August 16, 2023
KC9NKI QTH
Point A Back Yard Medium Signal
Noise strongest on east side of SR 162
Point C Strongest Signal
Point E Strong Signal
Point F Strongest Signal
Point G Weaker Signal
E 16th St
E 15th St
Virginia St
Homestead Pizza
AT EACH TEST POINT
KD9KNB's Diamond BB7V HF Antenna was connected to HF receiver (waterfall)

HF NOISE ANALYSIS (KC9NKI QTH)

Center of Back Yard

Point B: E 16'th Street and Virginia Street (Suspect Pole)



Point C: South East of Property (Main Street)

Point D: North-East of Property (Main Street)

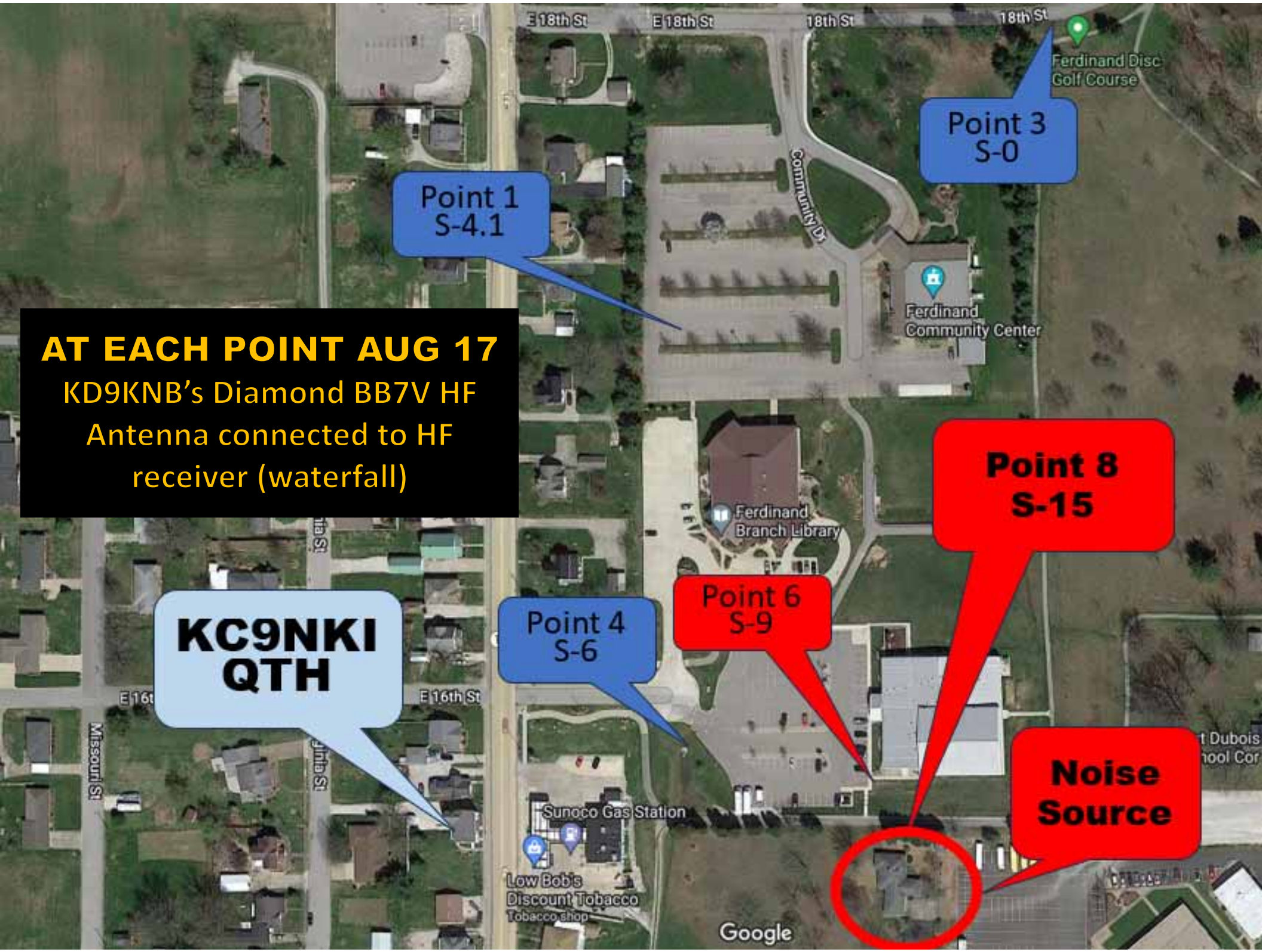
Point E: South-West of Property

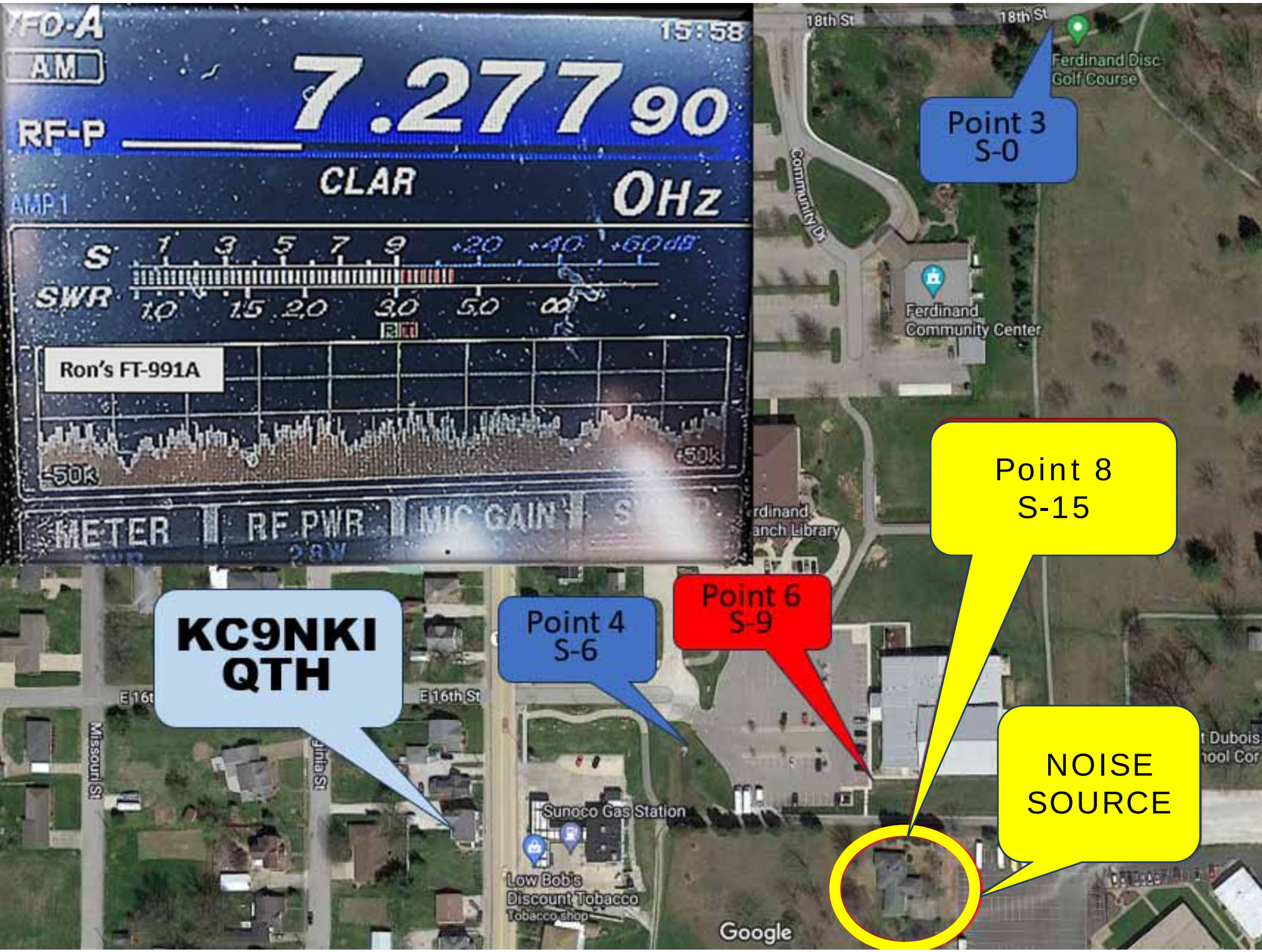
Point F: Behind Homestead Pizza

August 16, 2023

Step #5

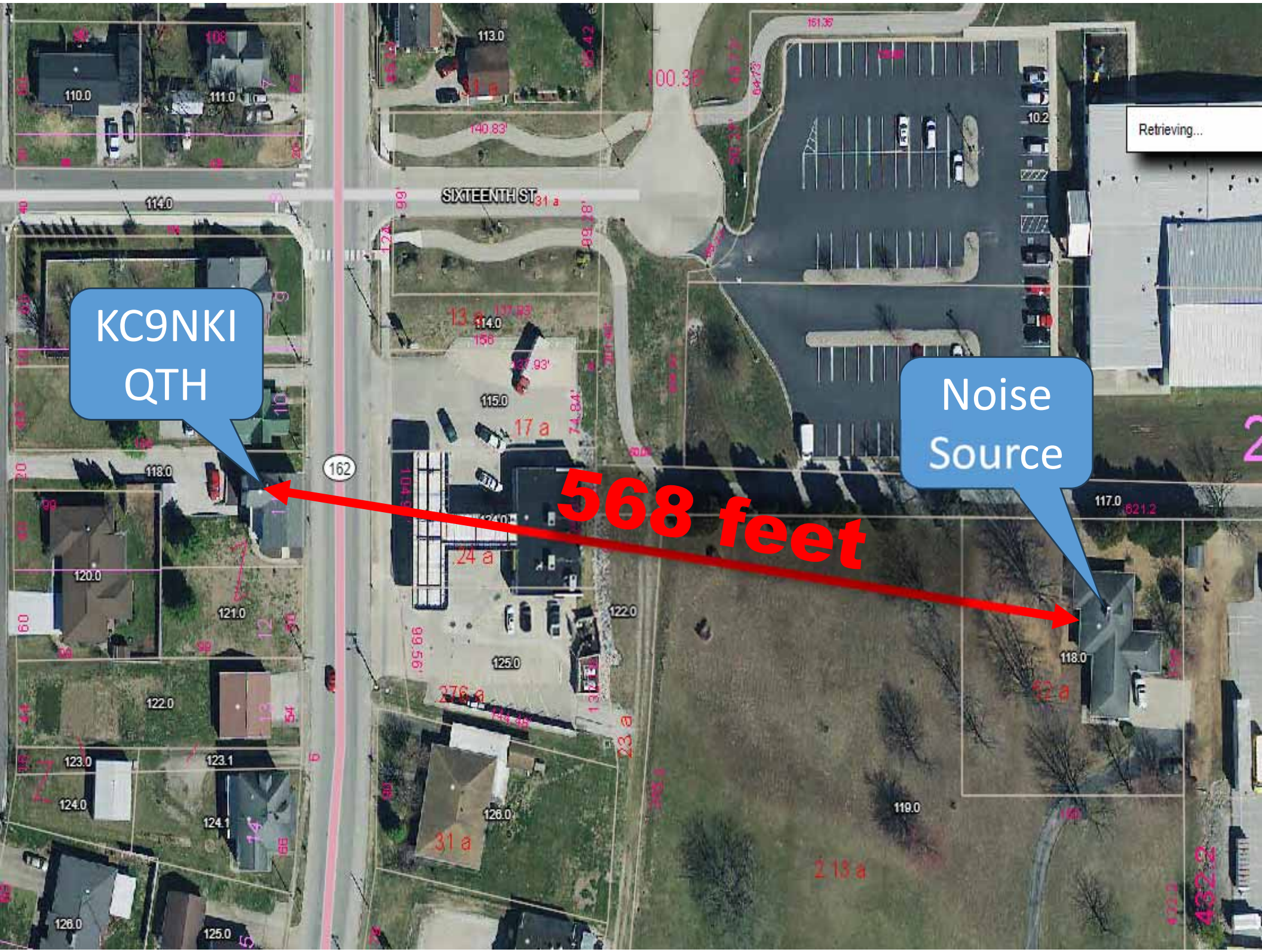
On August 17, 2023 the noise source search focused on east side of SR 162


AT EACH POINT AUG 17
KD9KNB's Diamond BB7V HF Antenna connected to HF receiver (waterfall)
KC9NKI QTH
Point 1 S-4.1
Point 3 S-0
Point 4 S-6
Point 6 S-9
Point 8 S-15
Noise Source
E 18th St
E 18th St
18th St
18th St
Ferdinand Disc Golf Course
Community Dr
Ferdinand Community Center
Ferdinand Branch Library
E 16th St
E 16th St
Missouri St
Sunoco Gas Station
Low Bob's Discount Tobacco
Tobacco shop
Google


VFO-A
15:58
AM
7.277 90
RF-P
CLAR
0Hz
AMP 1
S 1 3 5 7 9 +20 +40 +60dB
SWR 1.0 1.5 2.0 3.0 5.0 ∞
Ron's FT-991A
-50k
+50k
METER
RF PWR
MIC GAIN
18th St
Ferdinand Disc Golf Course
Point 3
S-0
Community Dr
Ferdinand Community Center
Point 8
S-15
Point 6
S-9
Point 4
S-6
KC9NKI
QTH
E 16th St
Missouri St
Sunoco Gas Station
Low Bob's Discount Tobacco
Tobacco shop
NOISE
SOURCE
Google

Pinpointing the Noise Source

- Sangean ATS-803 was used to isolate the noise source
- Noise source was initially thought to be lights along 18’th street walking path
- Later confirmed to be residence 332 E 15th Street which is 568 feet east of KC9NKI’s QTH


KC9NKI
QTH
Noise
Source
568 feet
SIXTEENTH ST
162
Retrieving...

Step #6

Isolating the noise source within the residence at 332 E 15th Street

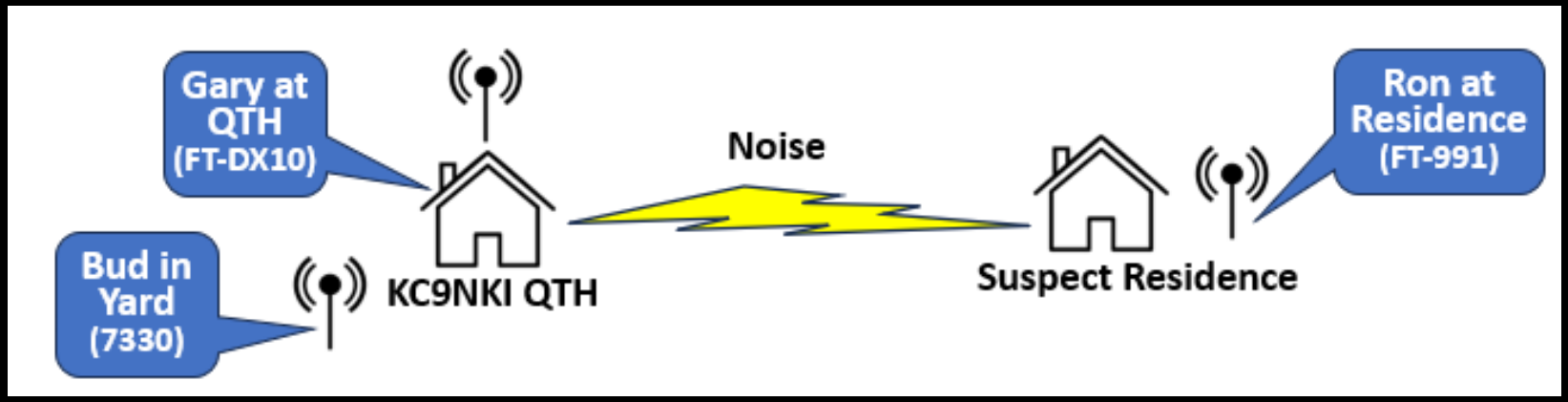
Pinpointing the Noise Source

- Residence owner was very cooperative
- The Circuit Breakers were turned off and the HF noise went away
- Turning the Breakers on one at a time revealed the Lennox HVAC system was the source of the HF noise

Pinpointing the Noise Source

A noise sniffer was used to detect the HF noise within the control cable of the Lennox HVAC unit

Pinpointing the Noise Source



We also confirmed conclusively the noise emanating from the residence was the noise affecting KC9NKI's HF radio on August 30, 2023

Step #6

Determine whether the HVAC system in violation of FCC Rules & Regulations

Contacted the ARRL to Determine the Applicable FCC Rules & Regulations

ARRL RFI Help Desk: (860) 594-0392

Stephen Anderson (RFI Engineer): w1emi@arrl.org

FCC Part 15 Sub-part B

FCC Section 15.5 (b) and (c) provide a "no harmful interference" clause that applies to the operator of an HVAC system:

(b) Operation of an intentional, unintentional, or incidental radiator is subject to the conditions that NO HARMFUL INTERFERENCE IS CAUSED!

(c) The operator of a radio frequency device shall be required to CEASE OPERATION of the device upon notification by the FCC and can only resume when the issue is corrected.

ARRL Recommendations

- **The FCC could force the residence owner to SHUT DOWN the device (Lennox HVAC) upon notification of causing harmful interference!**
- **In reality, the FCC WOULD LIKELY NOT DO SO for ham radio interference.**
- **IT IS BEST TO TRY AND WORK THIS OUT FIRST with the homeowner and HVAC company & the ARRL would assist, if needed.**

Step #8

Getting HVAC service involved to resolve the HF noise issue

This took quite some time and follow-up calls with the residence owner

Eventually a dialog was established and we moved forward

HVAC Service Assistance

- A+ Derr Heating & Cooling was provided with the details of the HF noise issue on 10/02/23
- They contacted the factory to determine actions needed to resolve the issue

- *We requested them to coordinate a service visit with us so we could be there with HF noise sniffer to confirm problem resolution*

A Week Went By with No Responses So I called A+ Derr

HVAC Service Assistance?

- On 10/12/23 A+ Derr visited the residence WITHOUT notifying us
- They apparently installed a ground rod to the HVAC system

- *We were NOT there to confirm whether or not they fixed the HF noise issue!*


While noise was initially throught
to be resolved, it returned
again on 10/21/23

At this time we decided to pursue other alternatives rather than immediately following up with HVAC service

An Alternate Antenna!

HF Horizontal Wire Antenna

- We decided to try an antenna less susceptible to noise
- The Comet CHA250 antenna currently is use by KC9NKI is a vertical which is prone to noise pickup
- A G5RV horizontal wire antenna would be temporarily set up and checked for improved performance and ***less susceptibility no noise***

The Antenna Test

Horizontal G5RV Wire Antenna

- A G5RV was tested at KC9NKI's QTH on 10/23/23
- MUCH IMPROVED PERFORMANCE was observed on 40M

- The HVAC noise was present but at a MUCH reduced tolerable level.
- KC9NKI is purchasing an end fed multiband half wave dipole

The Antenna Purchase

*EFHW-8010 80M-10M Antenna

- KC9NKI installed an EFHW-8010 half wave and fed antenna on 11/04/23
- Antenna is 130 feet long and is resonant on 80M, 40, 30M, 20M, 17M, 15M, 12M, & 10M

- Performance CONSIDERABLY better than CHA-250B

* Sold by MyAntennas.com

The Final Step

Installed MFJ-1026 Noise Canceller

Comet CHA250B
(Reference Antenna)

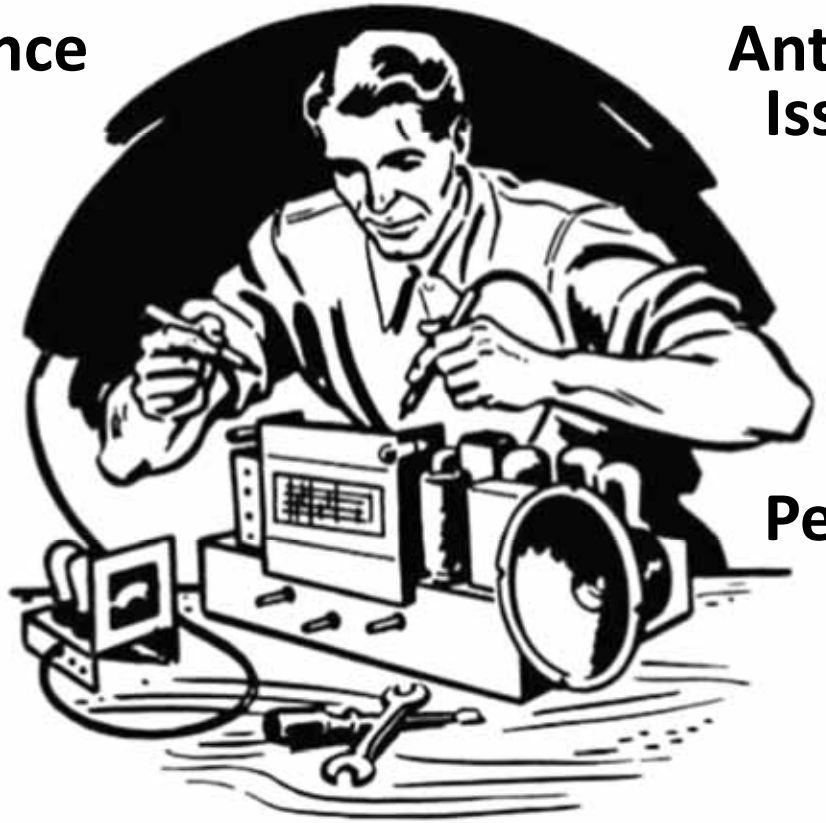
End-Fed Dipole
(Main Antenna)

- Installed April 12, 2024
- Eliminates ALL types of noise (power line, computers, digital)
- Completely eliminates any remaining noise!

Hams Helping Hams

Interference Issues

Antenna Issues



Equipment Issues

Installation Issues

Technical Issues

Performance Issues

Patoka Valley Amateur Radio Club

WB9LIB, N9NAU, & KD9KNB

40 Man-Hours Assisting KC9NKI


Thank You