

Severe RFI: Neighbors, ARRL, FCC, and Me



**Gary Johnson, NA6O
October, 2019**

Question: What might bring the demise
of ham radio as we know it?

NO-CODE LICENSING?

THE INTERNET?

CELL PHONES?

FT8?

.....???

RFI

Radio Frequency Interference

Even if it doesn't affect YOU, it affects everyone you want to work

Working thru a severe RFI case

Each step will be illustrated with my experience

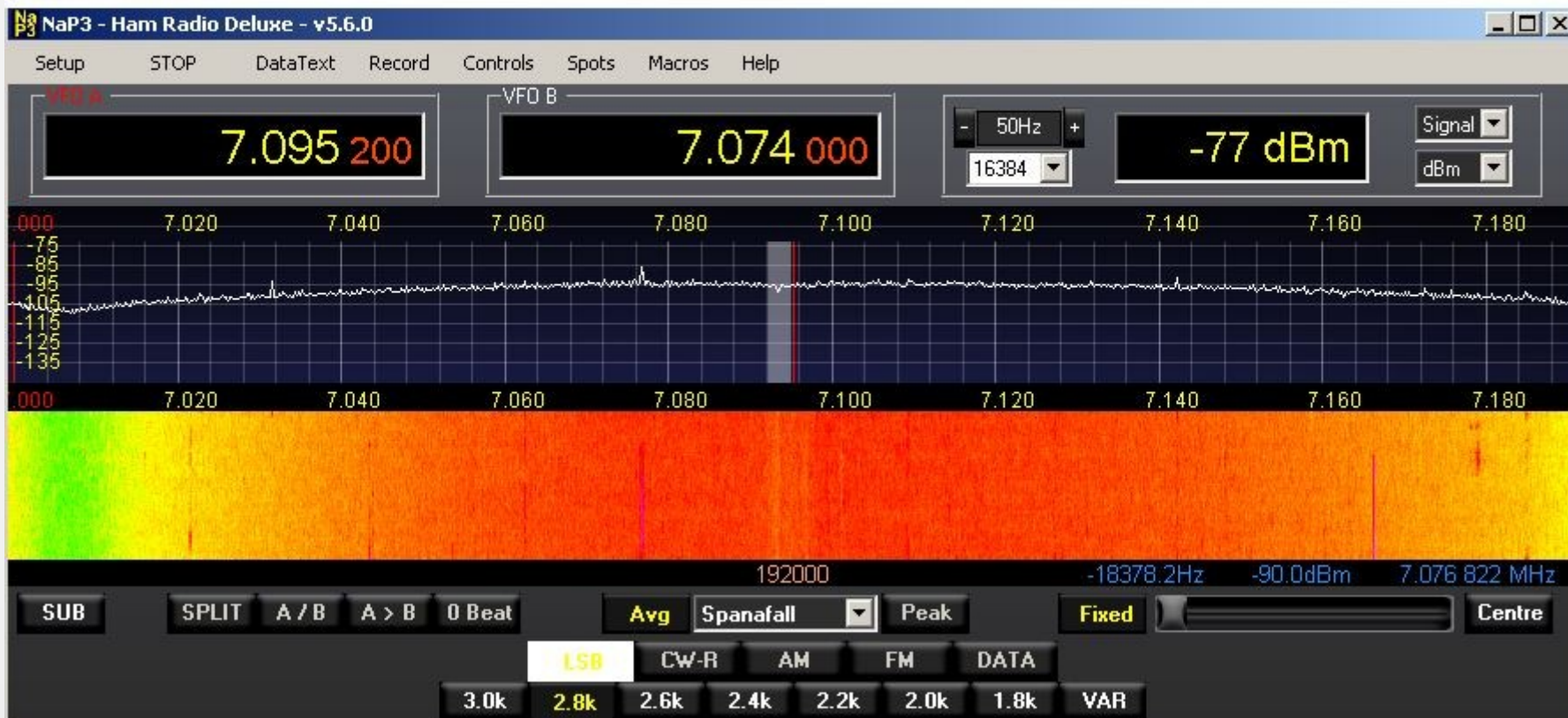
- Identify the source
- Keep a detailed log
- Talk to your neighbor
- Contact ARRL early; work on solutions
- Escalation: FCC
- Legal stuff
- Resolution
- References

1. Identify the RFI source

- Signal characteristics (fingerprints)
 - Frequency, strength, time of day, modulation characteristics, sound, SDR panfall display captures
- Direction finding
 - Pinpoint the right house
- In my case: Coincidence with contractor activity
 - “Hey, did you just install some new lights?”

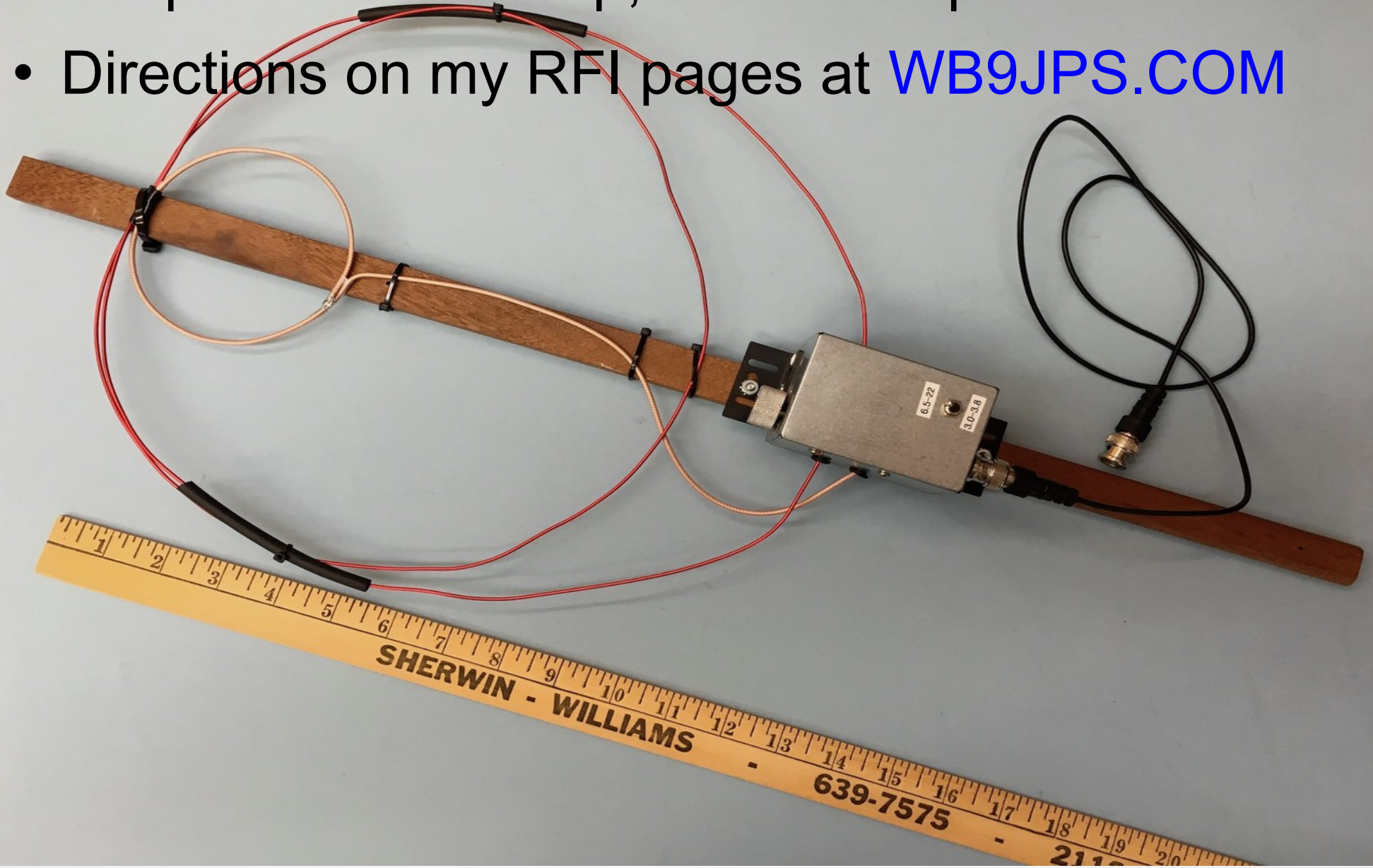
Feb, 2018: Sudden RFI onset!

- All-band buzzing, **S9 + 10 dB** on 40 meters
- Whipped out my direction finding gear, and it obviously was next door



Make a direction finding antenna

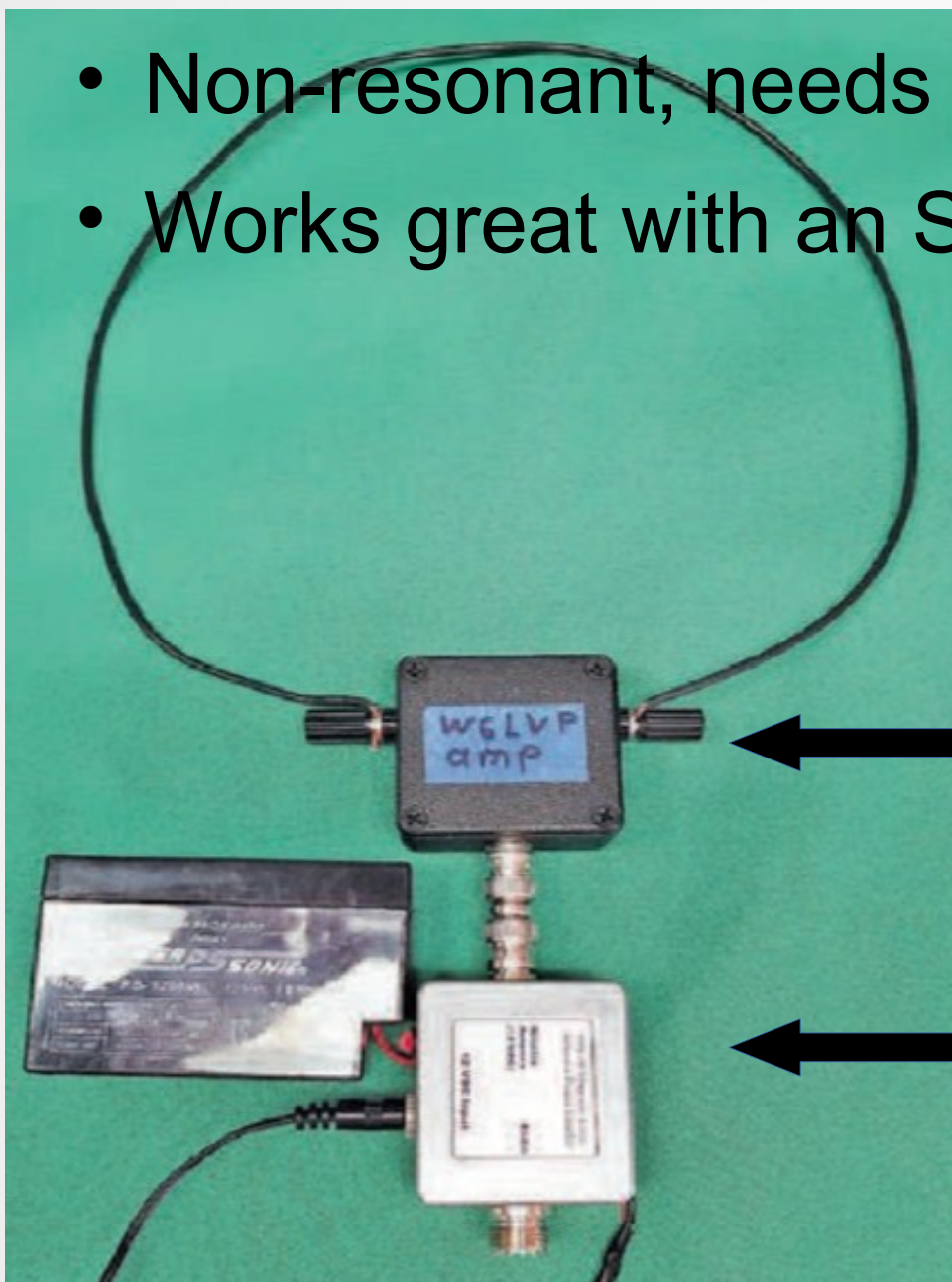
- Simple resonant loop, use with a portable radio
- Directions on my RFI pages at WB9JPS.COM



Or a wideband loop, nice with SDR

- Non-resonant, needs about 40 dB of gain
- Works great with an SDR or spectrum analyzer

Article by KQ6RS in
QST May 2019



← W6LPV amplifier

← Battery and bias inserter

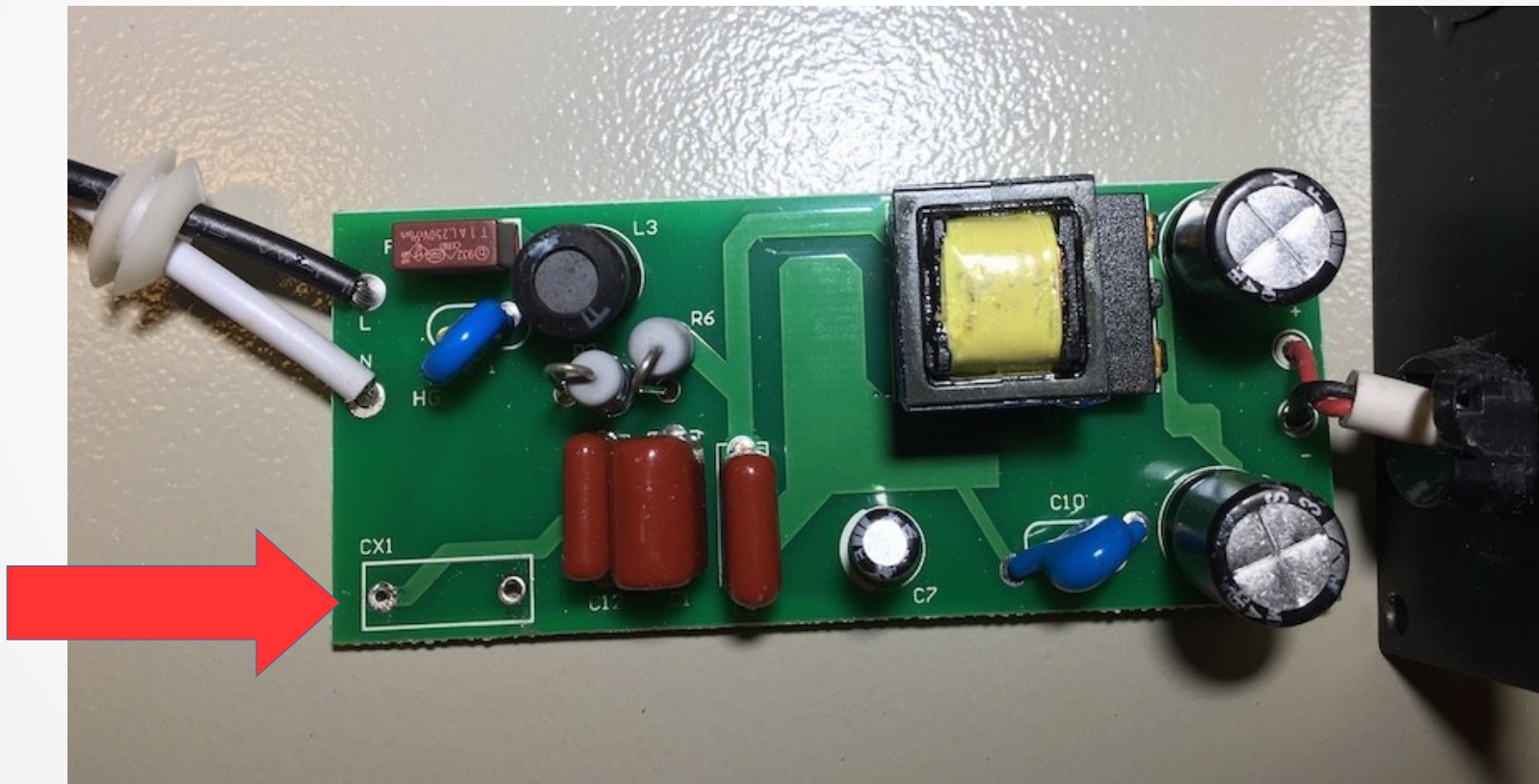
An electrician worked for a week...

- Installed 23 of these fixtures next door
- I bought one from him (\$40) to characterize

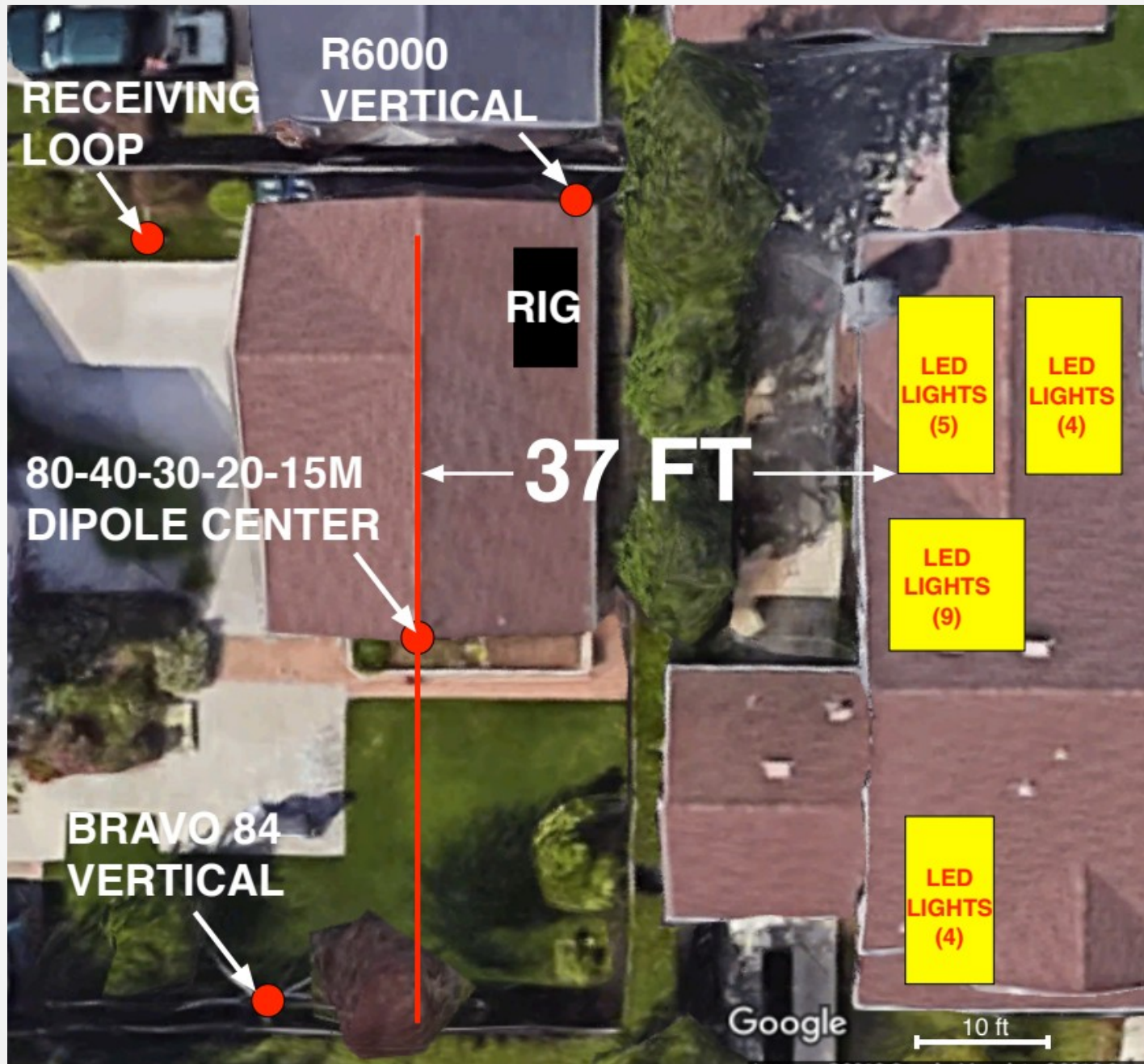


Root cause: NO filtering

- Zero filter components on AC line side of the converter module. This is very common!
- Pads for an X capacitor... but no component



The other problem: Proximity



2. Maintain a detailed log

- Write down everything, right from the start
 - ARRL, FCC, lawyers, etc. will really appreciate details
- Be **quantitative** when collecting observations
- What to record:
 - Time and date stamp everything
 - Signal characteristics: Freq, dBm, sound, etc.
 - Direction finding results
 - Content of every contact with neighbor, ARRL, FCC, etc. especially verbal conversations
 - Letters sent/received

Typical noise data spreadsheet

Date 3-14-18

Time 9:00 PM

Condition Downstairs LED lights on, upstairs dark.

Freq	TS-590 Ant.	TS-590 S	TS-590 dBm	SDR S	SDR dBm
3.7	Dipole	5	-86	5	-99
3.7	Bravo84	5	-86		
7.2	Dipole	9+10dB	-66	7.5	-83
7.2	Bravo84	9	-73		
10.1	Dipole	4.5	-87		
14.3	Dipole	4	-89	5.5	-96
14.3	R6000	3	-92		
18.15	R6000	4	-89	5	-98
21.3	Dipole	1	-96	5.5	-94
21.3	R6000	3	-92		
24.94	R6000	3	-92	5	-97
28.4	Dipole	5	-86	5	-97
28.4	R6000	3	-92		
50.3	R6000	0.5	-99		

3. Talk to your neighbor

- No threats! Calm diplomacy will always help
- FCC really wants us to fix problems this way
- This is another good reason to remain friendly with all your neighbors
- My previous neighbor was real nice, let me fix things on the spot. You never know til you try.
- **Don't** put anything in writing until you get advice from ARRL

We talked several times. No luck.

- I clearly explained the problem, in simple terms
- I explained the likely solution (filtering) since these are permanent fixtures
- Told him about FCC regulations on RFI:

The *operator* of the interference source is responsible for fixing it.

FCC is the sole authority in all such cases.

- He had no interest in taking any action

4. Contact the ARRL RFI team

- Phone ARRL HQ and ask for **Paul, W1VLF**
- (I worked with Mike, W1MG, now retired)
- Explain your situation
- They will offer advice on next steps, what to do, and what *not* to do
- They can test items for FCC compliance
- They can write letters to your neighbor
- They can initiate FCC action

AN INCREDIBLY VALUABLE SERVICE

Make a donation thru the *Spectral Defense Fund*

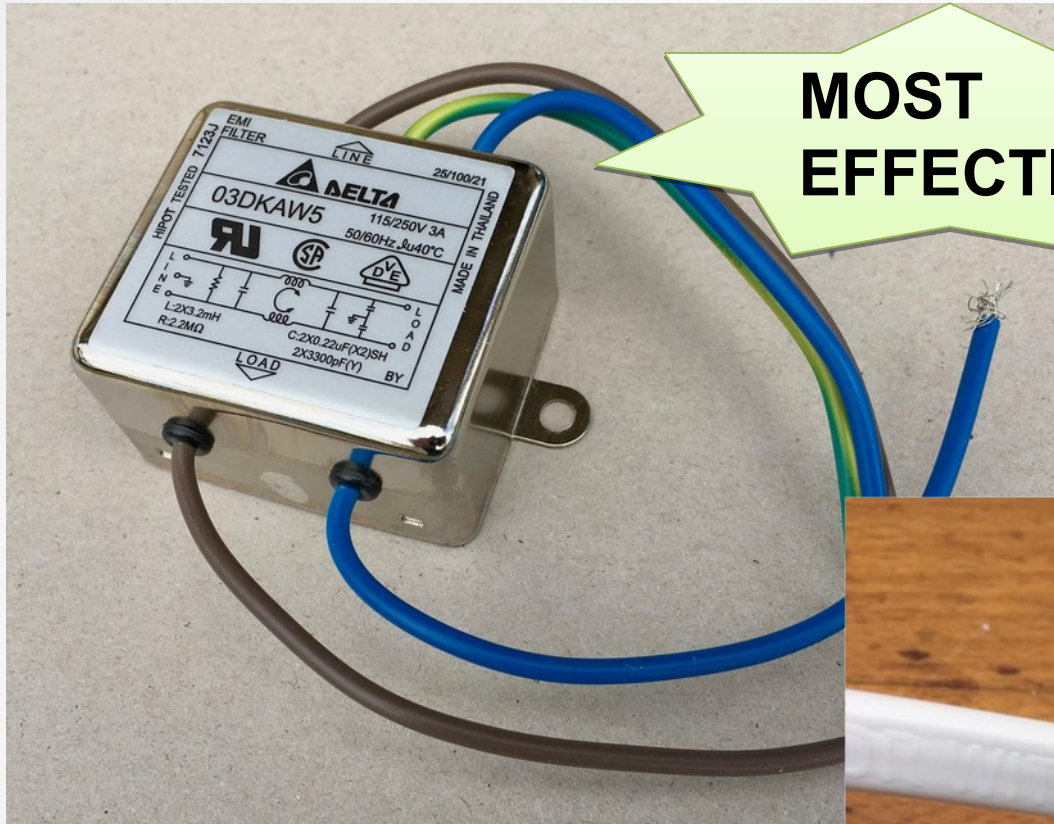
March: Sent fixture to ARRL

- Mike at ARRL tested the fixture for FCC Part 15 conducted emissions compliance
- It was just barely compliant. Also had a marking violation (Part 15 notice absent).
 - He notified FCC of the marking issue
- Since it was basically in compliance, the manufacturer would be unlikely to absorb responsibility for the RFI... but it pays to ask
 - They did supply some filters, but not effective

Lots of filter testing

- Mike determined that this fixture has really bad **normal-mode** conducted emissions
- I tested several commercial EMI/RFI filters as well as common-mode chokes
- Measured actual radiated noise to my station
- Commercial EMI/RFI filter was the best
(Ideally, filter components added to the PC board would have superior performance, but impractical or impossible to retrofit)

The final candidate filters



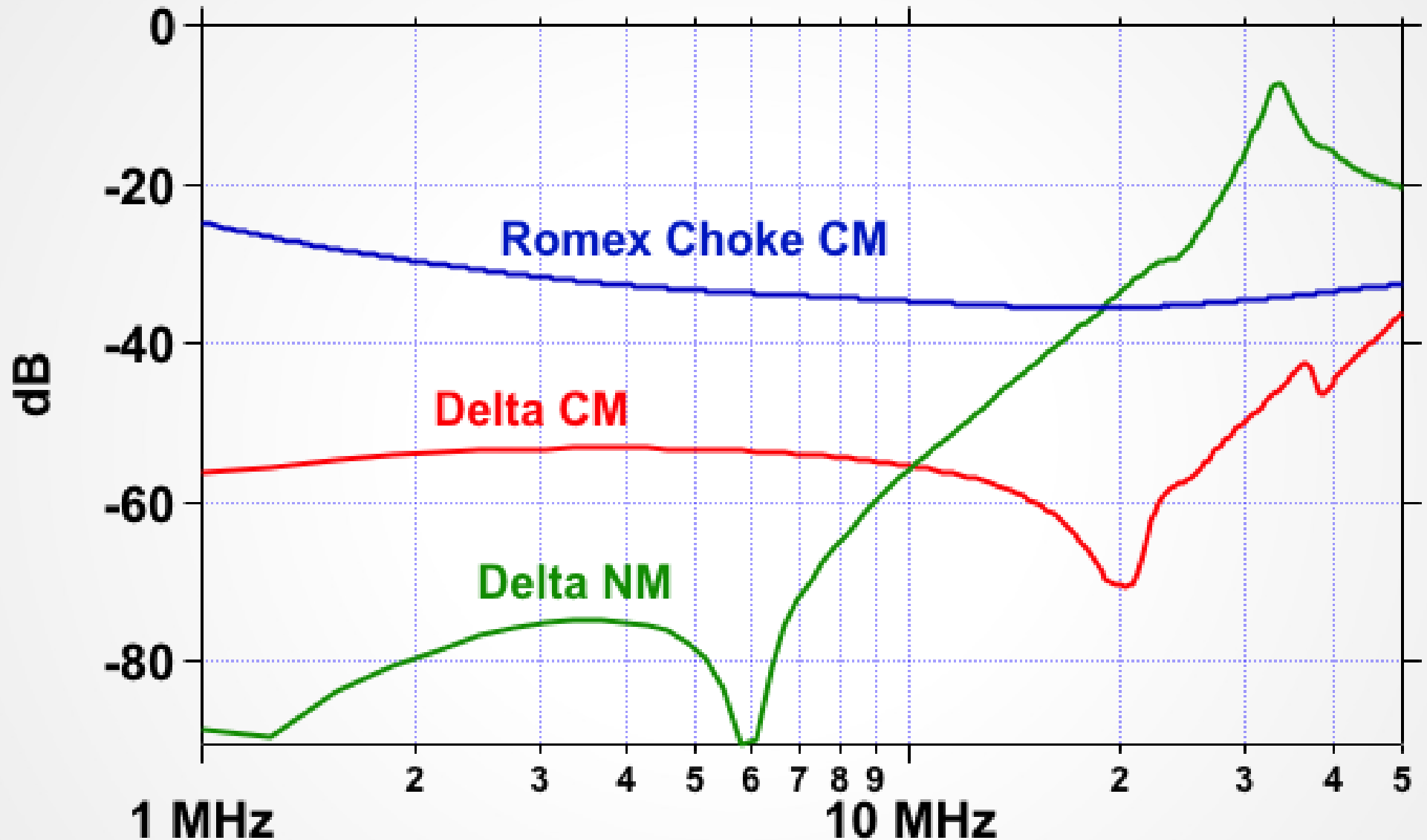
**MOST
EFFECTIVE**

**11 turns Romex
2.4 inch type 31**

**Delta 03DKAW5
3 A, single-section
\$8 in quantity**



Packaged filter vs. Romex choke



June: I wrote a letter to my neighbor

- Mike at ARRL edited it
- Mike also supplied a letter similar to what the FCC sends. Both went to my neighbor.
- General content:
 - His lights are generating noise
 - It's his responsibility to fix it per FCC
 - I volunteered to pay for the work

Formal but non-threatening

Then he went haywire

- **You are irradiating my children**

He likes keeping the lights on to prevent me from operating (jamming, anyone?)

- **Will not spend any money on this**

But I said I would pay for it...



July: ARRL sent him a formal letter

- Clearly states the legal situation
- Copy to FCC
- As a bonus, my neighbor got the HOA spun up. This is another ongoing, parallel battle for me. (Funny that it was all ok for 16 years.)



ARRL The national association for
AMATEUR RADIO®

Advancing the art, science, and enjoyment of Amateur Radio

ADVOCACY

MEMBERSHIP

PUBLIC SERVICE

EDUCATION

TECHNOLOGY

5. Escalation: Work with the FCC

- ARRL has various agreements with the FCC
- You do not have to initiate an FCC action yourself in this case. ARRL will do it for you.
- Remember that this is not your preferred way of solving RFI problems and it will not make your neighbor happier



Federal
Communications
Commission

September: The FCC steps in

- Letter from Laura Smith, Special Counsel in Enforcement at the FCC, to my neighbor
- She talked to the neighbor on the phone, and also called me
 - “He is digging in, refuses to do anything”
- **Neighbor: I am contacting my lawyer**
- So I got in touch with ARRL Volunteer Counsel
- Andy Faber, AE6Y, was most helpful

FCC's Laura Smith

Nice person, very knowledgeable



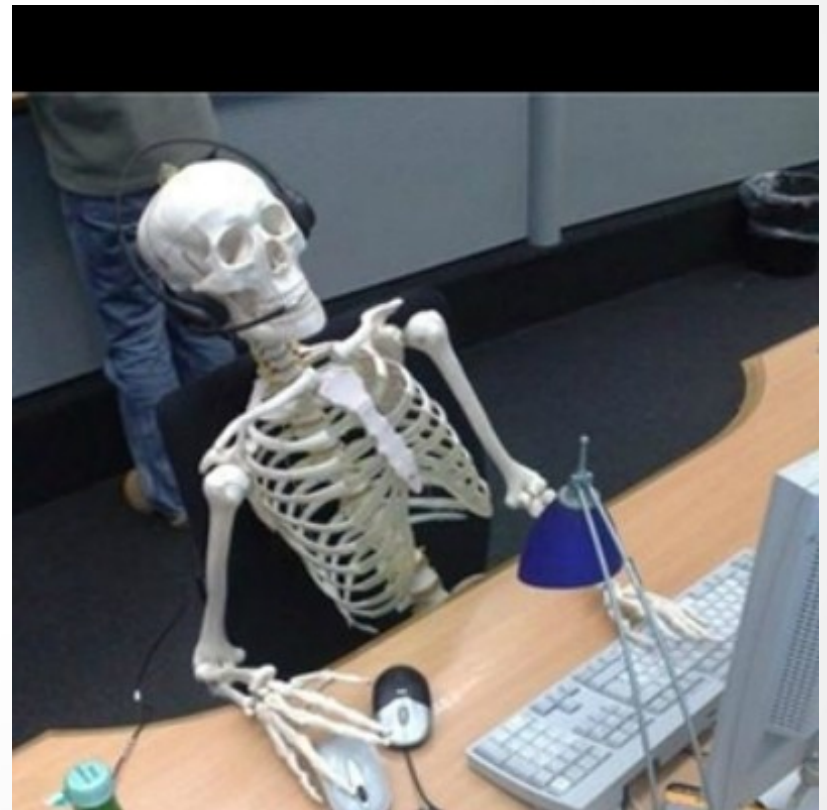
October: The clouds started to part

- After another call from Laura, my neighbor started to cool off
- I suspect that his lawyer said it was foolish to battle the FCC
- He came by and we had a nice chat
- Agreed to fix the lights as soon as the FCC made their official determination

FCC must do field measurements

- **Only the FCC can make a legal determination of harmful interference**
- The San Francisco Field Office investigates RFI complaints

November: Arranged for testing, but the guy never showed up



December: We can fix this

- Neighbor got assurance from the CA state Surgeon General Office that ham radio RF is basically harmless
- For other reasons, **they decided to move!**
- AND, he agreed that they would fix the problem, knowing it could otherwise encumber the sale



6. January: Resolution, at last

- Electrician came to install filters that I bought
- **Big problem:** They interact with the dimmers, causing a hideous flicker
- I had tested this exact setup but it didn't happen in my lab
- Tried another brand of dimmer, same problem

Oh, crap. The filters won't work...

Out of time...



So I quickly wound 23 chokes

- Good thing I had cores in stock, and had previously characterized the design
- These went in on the final day he owned the house!



100 ft of Romex and sore fingers

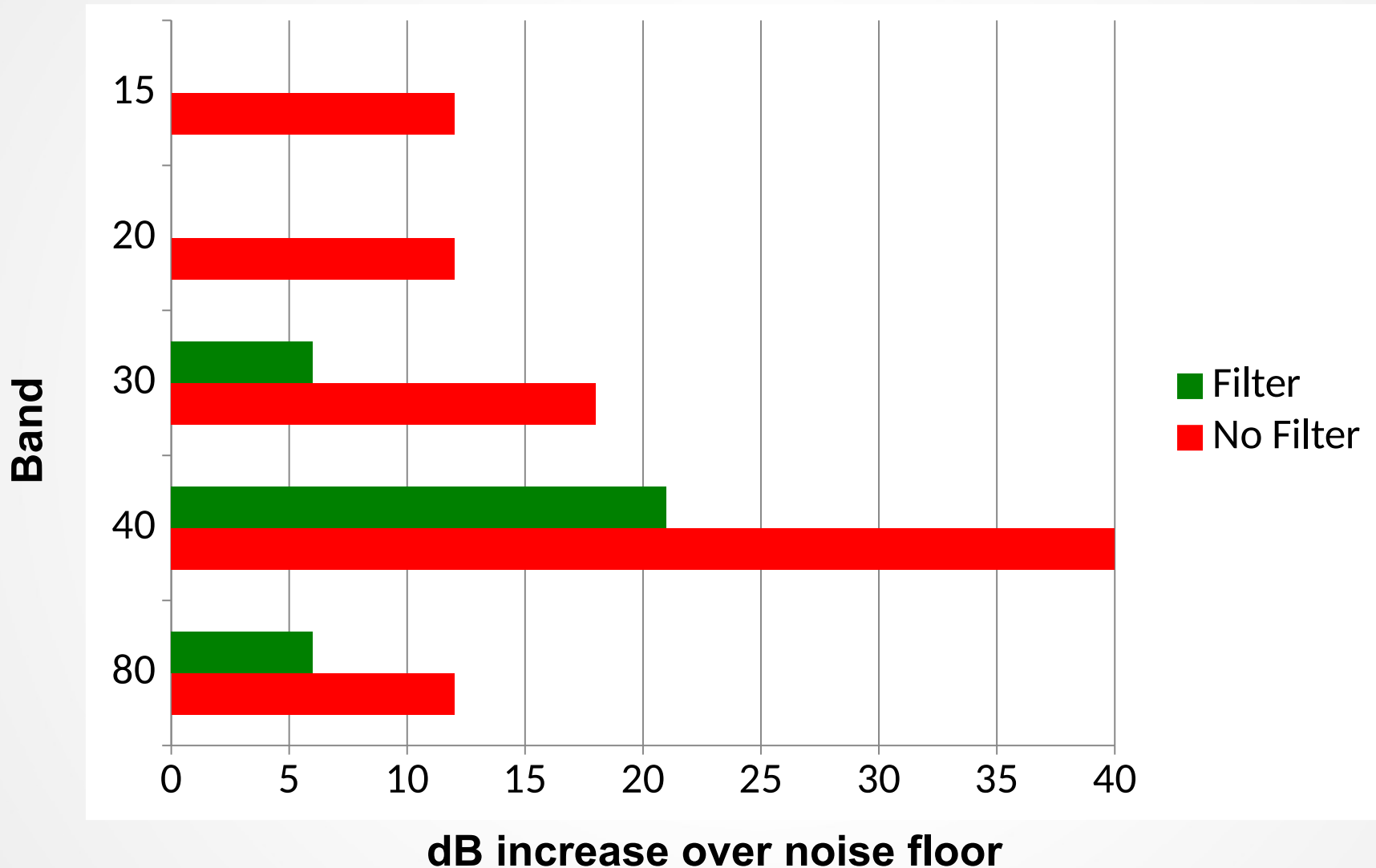


How well did the chokes work?

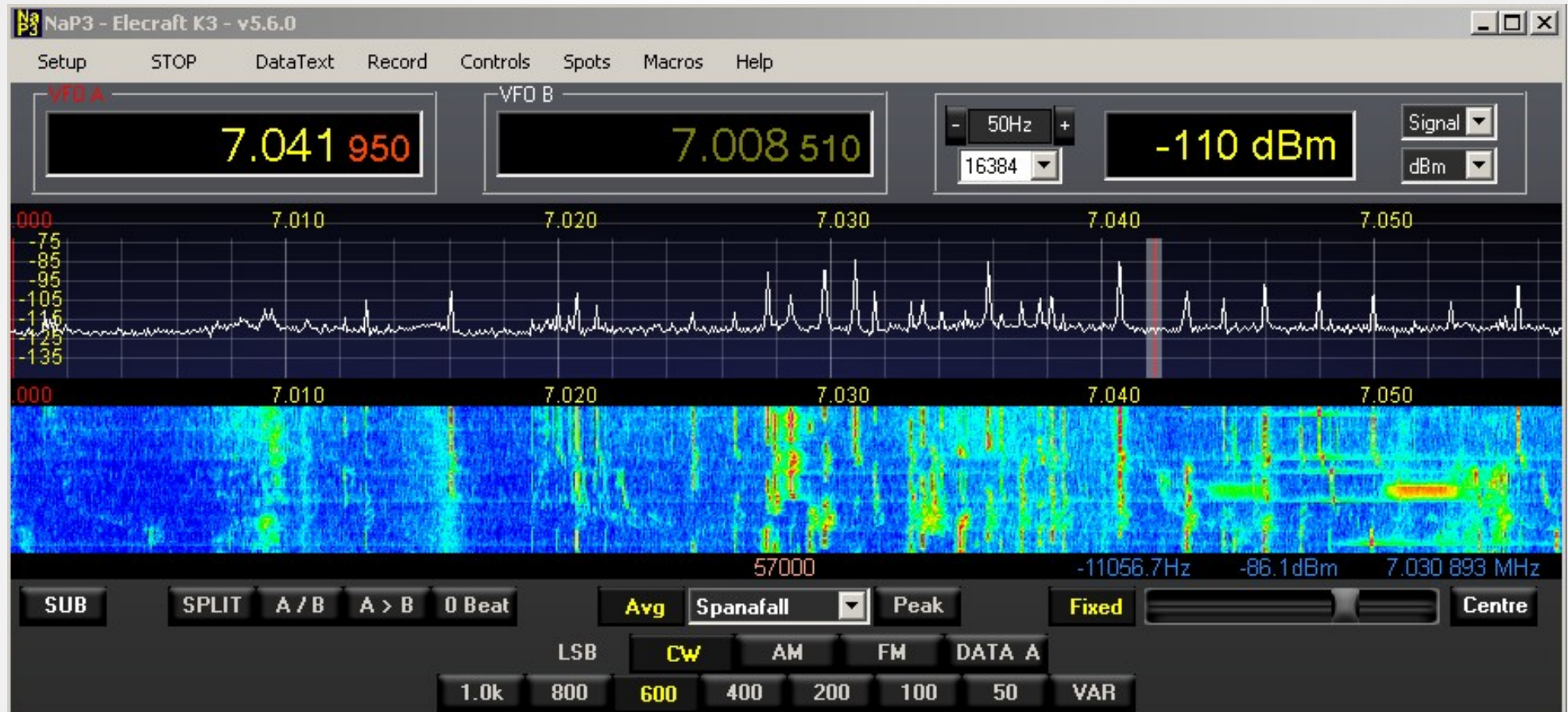
- Electrician turned things on and off while I recorded noise levels: **It's BETTER!**
- But also found yet another bad actor I had not previously identified: Under-counter lights
 - **Even worse than the main lights!**
 - **Impossible to mitigate**
- Detailed data entered into spreadsheet over the following weeks

Final results

Still obnoxious on 40; detectable on all bands

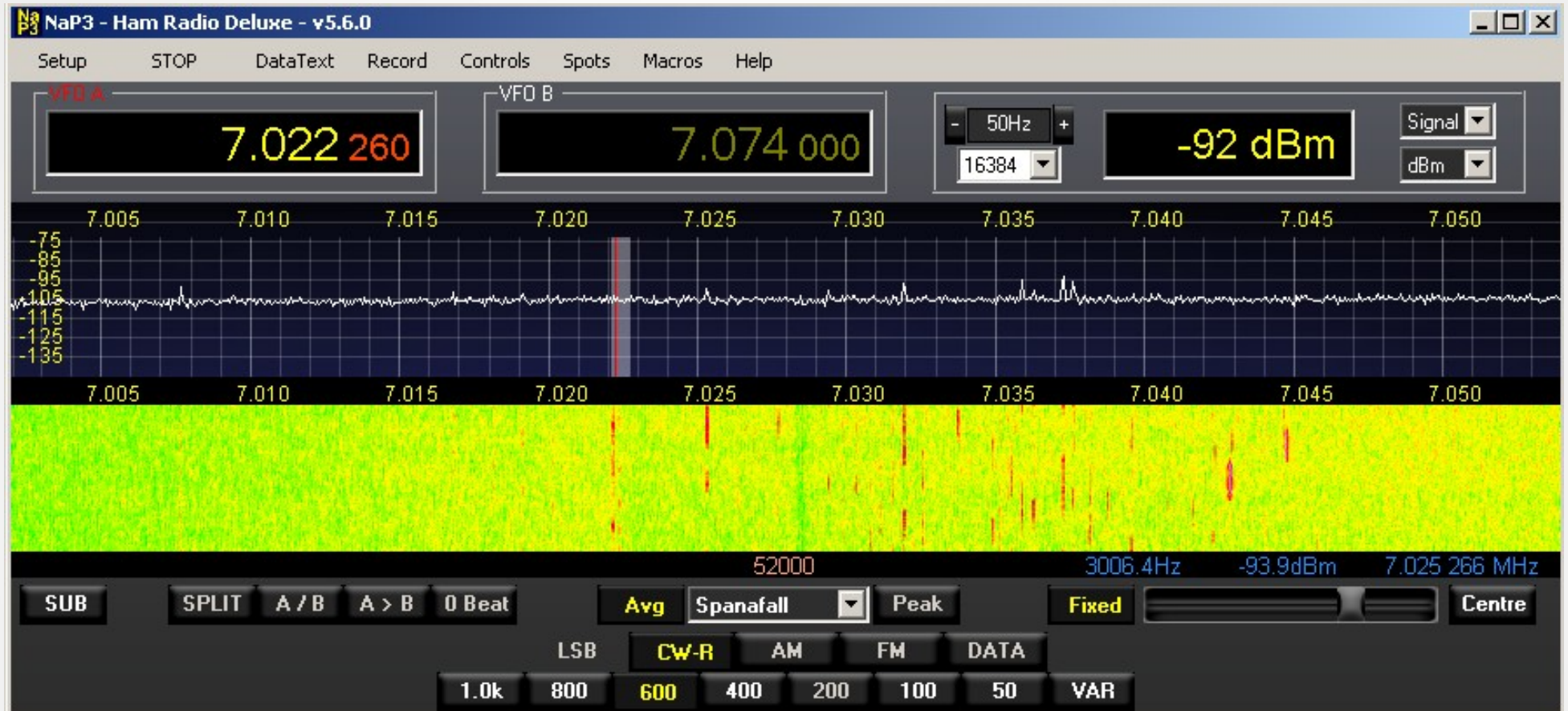


Panfall, lights OFF



During evening CWT

Panfall, lights ON



During evening CWT

Then they moved out

- Blessed silence at last
- But it only lasted until the new folks moved in

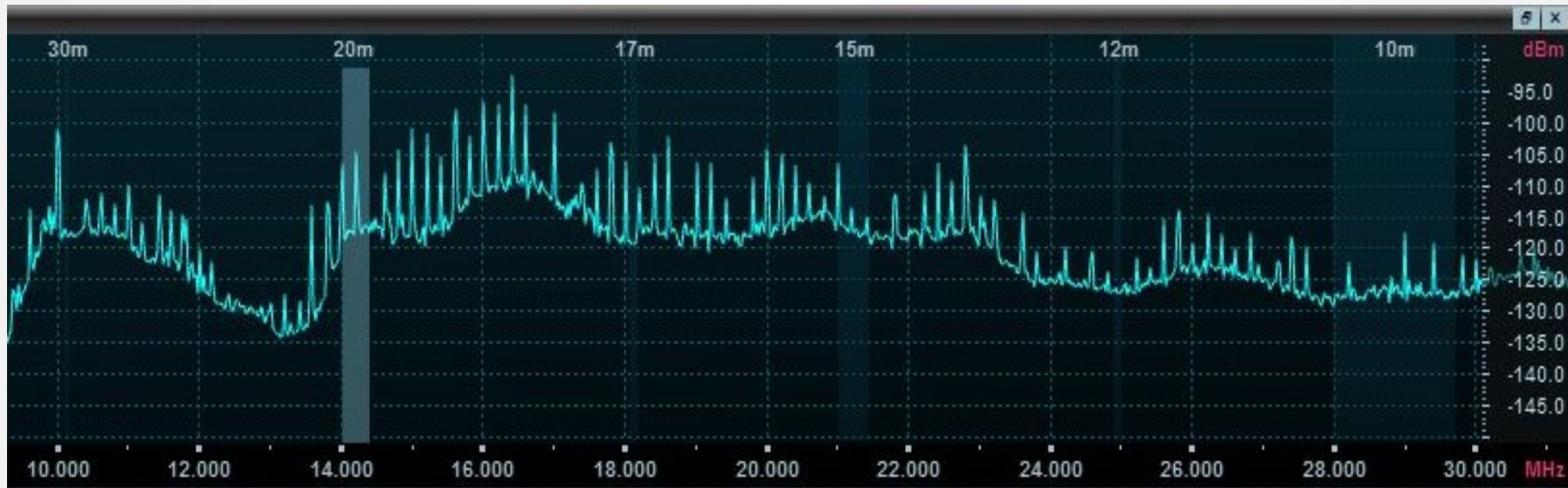


New neighbors...

- Already contacted them. Fixed an RFI problem in their surround-sound system.
- The guy grew up next to a ham, understands what it's about
- Told him I would teach his kids electronics, radio, machining, woodworking, engine repair...
- Willing to work with me. This is the key!

...Installed solar panels in May

- SolarEdge with Panel Optimizers
- Well-known as an RFI generator
- Here we go again... Vendor working on it.



Lessons learned

- Process mostly went by the book
- Relations with neighbors are very important
- ARRL is your most valuable resource
- FCC can be a final, big hammer
- Practical matters can override your preferred solution
- It takes a long time

References

- ARRL RFI Book
- ARRL RFI web pages <http://www.arrl.org/rfi>
- K9YC publications on RFI, noise, and chokes
<http://k9yc.com/publish.htm>
- NK7Z RFI pages <https://www.nk7z.net/>
- My RFI pages
http://wb9jps.com/Gary_Johnson/RFI.html