The Wireless

February 2025

The Garden City Amateur Radio Club

PO Box 482 • Garden City, MI 48135-9998

Next Meeting:
Tuesday, February 17, 2026
7:00pm
Garden City Presbyterian Church
1841 Middlebelt (just south of Ford)
Garden City, MI 48135

Due to the extreme cold weather, last month's meeting was conducted using Zoom® teleconferencing software. Our apologies to anyone that missed the announcements or was unable to log in.
For the near future, we are planning to use Zoom as a back-up when in person meetings are not possible for various reasons. If you do not have the program on your computer or phone, we would encourage you to download it. It's safe, doesn't take up much space, and is easy to learn and use.
If you'd like more information about Zoon, please contact Brent, KF8CTO or Ray, KC8RC. They'll be glad to help.

From KF8CTO: Congratulations to Chris KF8FTB, with help from Hamshack Radio Podcast, to for getting a license entirely online (test included) we welcome you back on the air in Michigan!
Check out some interesting videos visit YouTube and search KF8FTB or visit hamshack.tv.
Warning, some of his material (language) is not appropriate for families.

Does anybody recognize these two?

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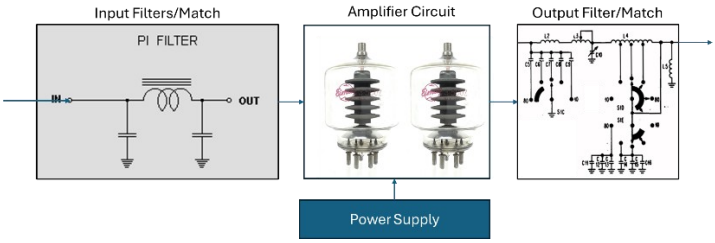
Mat-Matics # 127:
Experiments with a Henry 2K Classic Linear Amplifier

-Mat Breton, N8TW

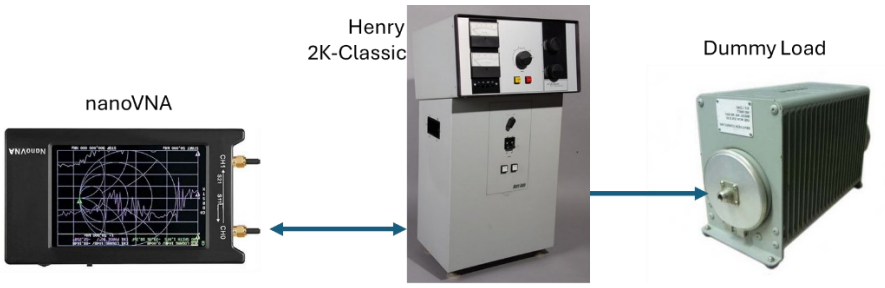
Overview: I love my Henry Radio 2K-Classic Linear Amplifier. It has some advantages over solid state amplifiers (SSAs):

- The output is very clean. The high-Q output tank circuit acts as a very narrow BPF (band pass filter) that screens out harmonics.
- The 3-500Z tubes are resistant to abuse from higher-SWR conditions.
- I purchased my Henry amplifier for $500, much less than the cost of an equivalent solid-state amplifier.

In previous articles I have taken measurements regarding the operation of the 3-500Z triode tubes (voltages, currents, thermals). In this article I will switch to the input side of the Henry, concentrating on the circuits transferring power from the exciter/rig into the tubes.

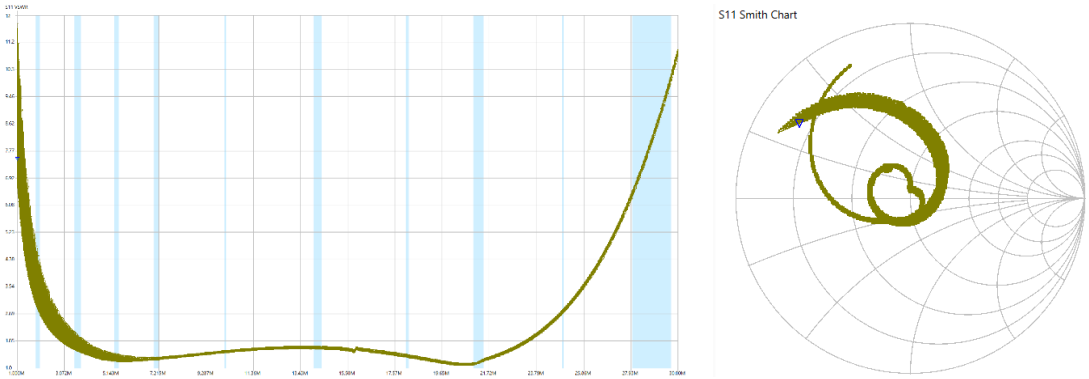


Measurement methodology: I used a nanoVNA to directly measure the input impedance. This can be done while the unit is powered, as the nanoVNA oscillator is very low power (~3 mW). The nanoVNA is a two-port Vector Network Analyzer, meaning it can measure the complex impedance of devices. In a 1-port reflection measurement (which I used to measure the input impedance) the S11 port of the device is attached to the input of the linear amplifier. It works by sending a specific frequency signal out the port, while simultaneously measuring the phase and magnitude of any reflected signal. By sweeping the generated signal frequency charts can be generated.



Measurement Setup

Measuring the Input Impedance: When power the unit up the resulting traces displayed an instability that can be seen below as jaggedness.

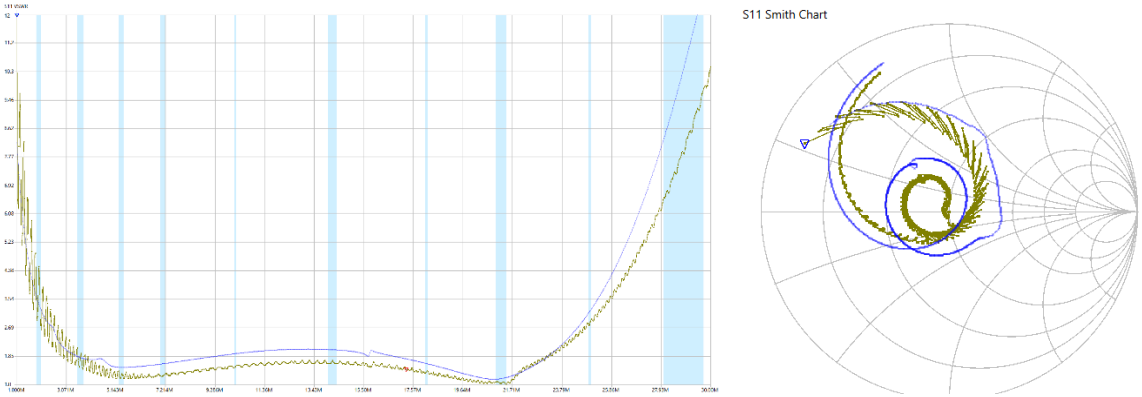


Powered Input Impedance: VSWR (left), Smith Chart (Right)

The nanoVNA excitation likely generates harmonics within the powered amplifier. While the input π filter attenuates these components, it does not fully suppress them, resulting in harmonic leakage that appears to the nanoVNA as reflected energy. Given the instrument's high sensitivity, this leakage influences the measured response. The effect is more pronounced at lower frequencies, where the input filtering is less effective. Changes in sweep step size also shift the apparent instability frequency, which may be attributable to aliasing.
Despite this behavior, the observed instability is minor and can be reasonably disregarded. The nanoVNA provides sufficiently accurate measurements of the complex input impedance. Conventional devices such as RF circulators or isolators are unsuitable in this case, as the reflected signal used for impedance calculation is intermixed with harmonic content.

Experiment #1: Powered vs Unpowered Input Impedance

Unlike many earlier Henry amplifiers, the 2K-Classic does not permit adjustment of the input matching network with the amplifier assembled. The variable inductors are not externally accessible, even with all panels removed, requiring extraction of the RF deck for retuning. Tom Rauch, W8JI, describes an alternative approach in which the amplifier is unpowered and a non-inductive resistor, representing the tube drive impedance, is placed between the anode and cathode to simulate operating conditions. To evaluate the validity of this method, I measured the input impedance in both the powered state and the unpowered state with the simulated load installed.



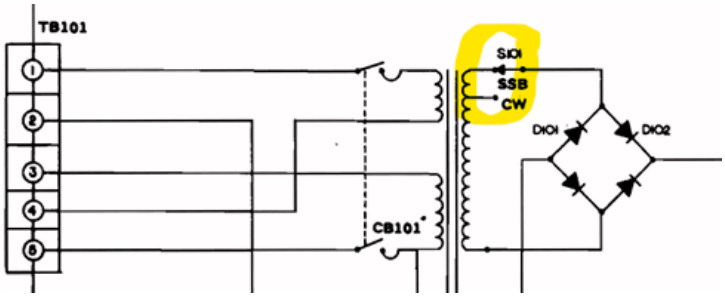
VSWR Powered (Green) vs Unpowered (Blue), Smith Chart

[*Editor's Note: Mat's article included circles to help clarify these graphs. Unfortunately, my publishing software did not allow them to be overlain. -df*]

The conclusion is that one can "tune" or analyze the input circuits using an impedance analyzer whilst the unit is either powered, or unpowered (but with the parallel resistor added to the tubes). At resonance the difference is very small.
Notice the "glitch" near 13.5MHz in the plot above … we'll get to the that later.

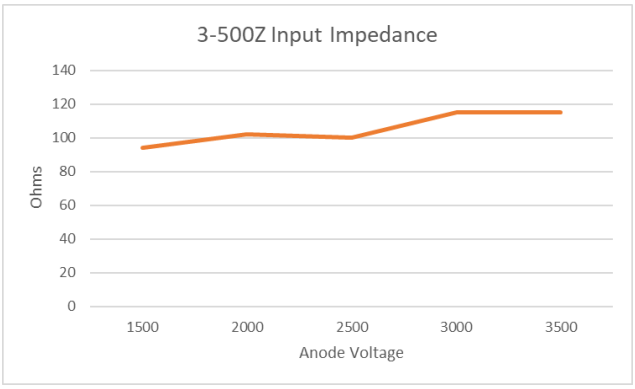
Experiment #2: Effect of Plate Voltage on Input Impedance.

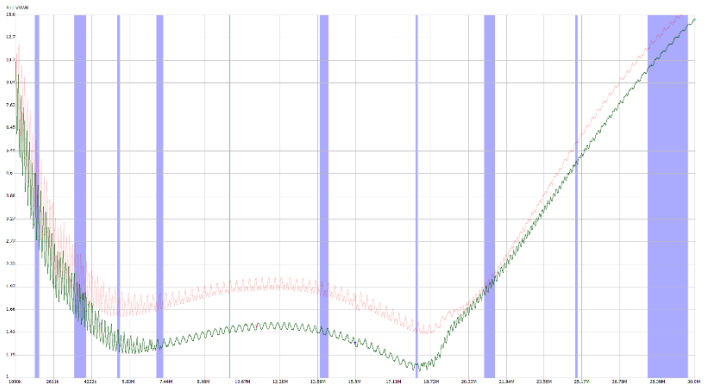
The 2K has a switch that changes the plate voltage between 2100V (CW Position) and 3100V (SSB Position). In the CW position the lower plate voltage would result in a lower maximum gain for the 3-500Z tubes, so a lower maximum power output. The CW position was designed to provide a power-limited solution as the high-voltage transformer was not designed for "key-down" operation at maximum power. A user can put the amp in that mode to ensure that they did not accidentally damage the amplifier (specifically the anode power supply).



Mode Switch, Circuit

We know that for a common-grid (aka cathode-driven, or grounded-grid) amplifier circuit the input impedance is dependent on mu, and mu is dependent on plate voltage (among other things). Therefore, as plate voltage rises, mu rises, and impedance should also rise. The input circuits (primarily the PI circuit capacitors) would have been designed for either one, the other, or a compromise voltage.



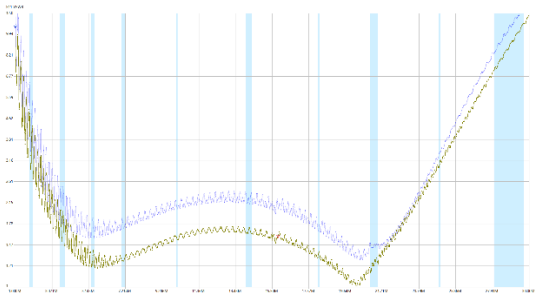


Input Impedance vs Plate V (Left), Henry Input Impedance for CW & SSB Voltages

Conclusion: The effect of the plate voltage change is obvious in the measurements and aligns with the theory. The Henry comes from the factory with the input circuits tuned for best match in the SSB (Higher Voltage) mode. While it is easily possible to operate on most bands in either mode, I usually just leave it in SSB (higher power) and use the output power/RF control on my rig/exciter to limit power. Because the feedline distance between the exciter and linear is small, the impact due to power loss is negligible. Note that on 17M the input SWR is naturally high, and when in CW mode the exciter (rig) may start to derate … on this band it might make a difference when not using the rig's internal matching unit.
Note that the plate voltage in the amp is higher than the design nominal as house voltage has risen in the US. Also, my house location (vs the position on the utility string) is higher as I am closest to the transformer. The difference is still not enough to redesign the input circuits to lower the SWR further.

Experiment #3: Effect of output tuning on input tuning

This is an important question for the older Henry designs that do not have specific input circuits for the WARC bands. For these we use the "closest" input band match, and re-adjust the output circuit. I was interested to see how much of an effect that had on the input match.

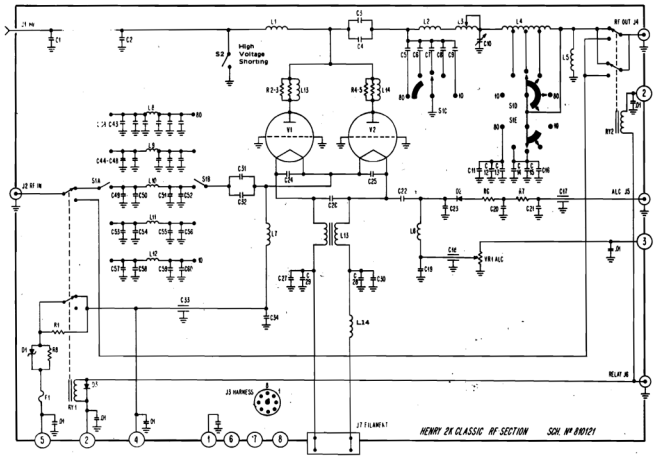


Output PI filter tuned (green), untuned (blue)

The answer is that there is a small effect in frequency, but a measurable impact on the overall VSWR. In conclusion, it is better to tune the input circuits while the tank circuit is at resonance to minimize error.

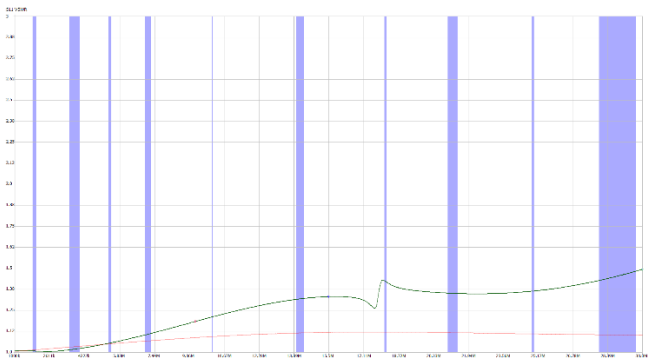
Experiment #4: Parasitic effects of output tuning circuit when in bypass mode

When in bypass mode (the linear is not transmitting) there should be a direct path between the input and output ports: all the input, amplification, and output circuits are removed from the equation. Theoretically, the linear amplifier should "disappear" from the equation; in reality there will always be some small effect, but if the effect is significant there is likely an issue:

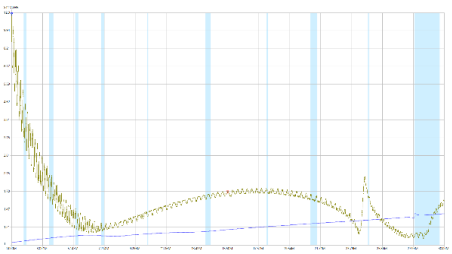


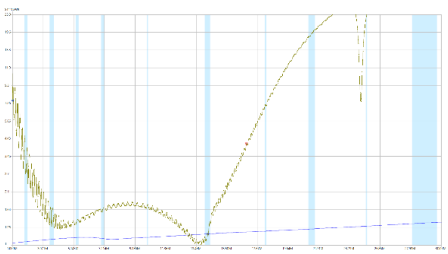
Henry 2K-Classic RF Deck Schematic

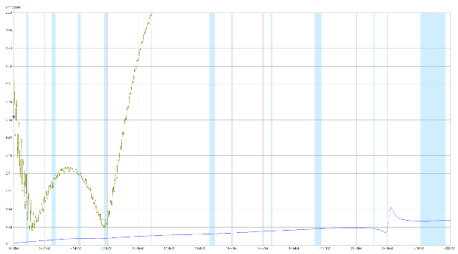
I measured a direct path from nanoVNA to the dummy load to get a baseline. I then measured with the unpowered amplifier inline (in bypass): The lower trace represents the nanoVNA looking into the 50 Ohm dummy load. The delta between the two lines shows the effect of putting the linear amplifier (bypassed) inline: there is a increasing mismatch as frequency rises, and a distinct resonance occurring.



For each band 10-12-15-17-20 meter the resonance point moves as the band is changed. 10M, 20M, & 20M are shown below as examples. Note that this resonance point is also seen in the powered operational state (green trace) to a higher degree.

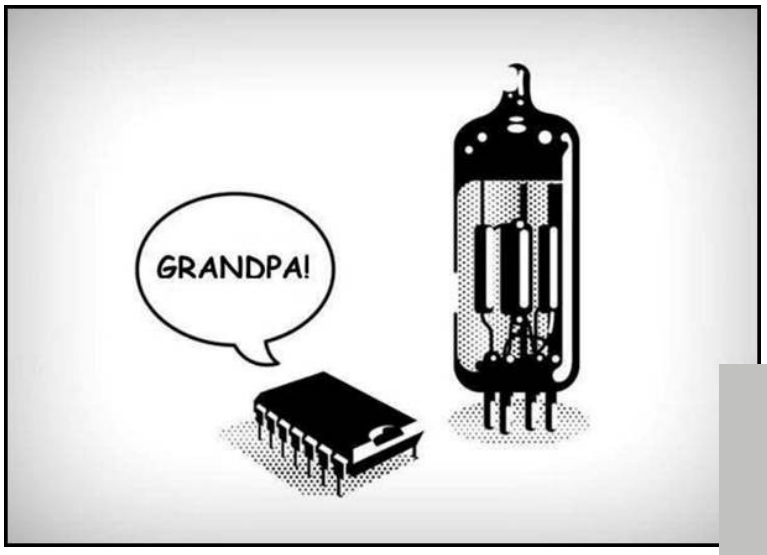


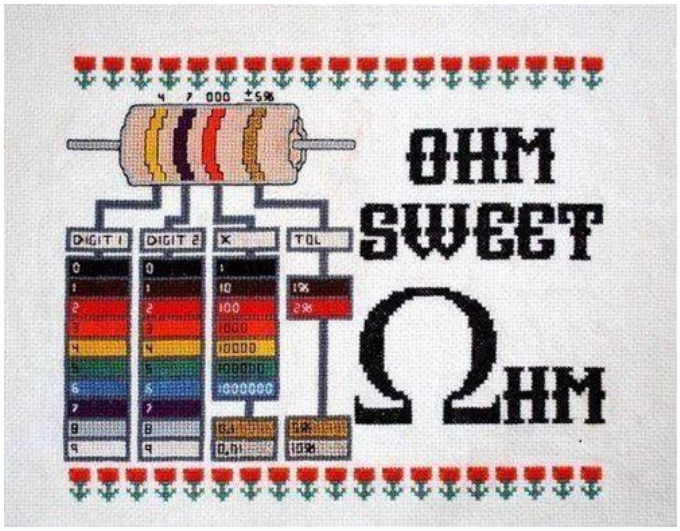




I suspect that the signal routing inside the chassis is too close to reactive components and we are getting coupling.

Summary: There is nothing new or earth shattering in the above experiments. I verified several theories and understandings I had about the linear amplifier. I discovered one operational quirk regarding the coupling in bypass feature, but there are several workarounds (primarily an external amplifier bypass). I plan to check cable routing and shielding the next time I remove the RF deck from the amplifier. Stay on-frequency for more experimentation in the future … specifically the output filter/match section.





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Etiquette on the Air

-Elmer Post (with apologies to Ms. Emily),
with assistance from KF8CTO and KC8VCX

Recently I was talking with a couple of relatively new hams. One of them mentioned to me that the reason he didn't go onto the nets very often was because he wasn't quite sure about the proper protocols. We came up with the idea of a series of articles outlining the proper procedures and etiquette for various repeaters, nets and such.

Remember, these are just guidelines, not "carved in stone" rules or laws. The FCC is not going to come after you for using a wrong phonetic. Unless you're on a formal structured net (such as Skywarn® or ARES), you're probably not going to be corrected for a simple error. The bottom line is listen first to see what everybody else is doing, then go ahead and join the party!

Here are some basic rules for any net, on essentially any band:

- Follow FCC rules. This means identify yourself with your Call Sign at the beginning and end of your transmission, and every 10 minutes if you talk that long.
- Another FCC rule: Refrain from using obscene language, sound effects (like whistling) or bodily noises on the air. If you do so accidently (see side box), own it, apologize and move on.
- Don't intentionally talk over someone else. Doing so will cause your signals to interfere with each other, and everyone will just hear garbled sounds.
- Avoid personal pejoratives or negative comments. If you wouldn't say it out loud at a meeting, don't say it on the air.

GENERAL GUIDELINES FOR USING THE GARDEN CITY (RAGC) REPEATER:

- Announce your presence: This is nothing formal. When you first tune into the RAGC Repeater, just key your mic and say, "XX8ABC monitoring." Instead of "monitoring," you might say "listening," "standing by," or something similar. It doesn't really matter; you're simply saying that you are on frequency. Do this for two reasons: (1) you're letting anyone else that is on frequency know that you're there and available if they want to talk, and (2) it reminds others that might want to have a conversation that they are not alone on frequency. Remember, you are never alone on the repeater. Always assume that other people are on frequency and listening. I personally know more than a few non-hams that enjoy listening to repeater frequencies with a scanner.
- Broadcasting is not allowed. Per FCC rules (yea, they keep popping up), there are only 3 instances where you are allowed to transmit to "no one in particular":
  1. Announcing your presence (see above)
  2. Asking All Stations to please stand by. This is generally used at the beginning of a net. It may also be used before an emergency transmission or if responding to an emergency call.
  3. Making a distress or emergency call, where life, property or safety are at stake.

  Technically, (2) and (3) would be calls to "any station," and would not be considered broadcasting.

TO CALL A SPECIFIC STATION:

Simply call the call sign of the person you are calling (how many times can I use the word "call" in one sentence?), followed by your own. For example, "XX8CAB this is XX8ABC." If they don't respond in about 30 seconds, repeat your call. If they still don't respond, remember to clear the repeater: "XX8ABC Clear." This lets anyone else that might want to use the repeater know that it's available.

Remember also to "clear" when you've finished a conversation.

GENERAL GUIDELINES FOR CALLING ON THE GCARC NET:

Net protocols are a little different, although everything listed above still applies. Please bear in mind that this procedure is specific to the GCARC Net, and that other nets in the area may be slightly different. Again, listen first and make note of the differences.

It's easy to join in the net. Listen to the instructions of the Net Control Operator (NCO); he will walk you through. The Net is divided into 5 parts:

1. The preamble, a lot of stuff the FCC requires us to say. This is where we identify the repeater (yes, the repeater has its own call sign) and the NCO, and lay out the basics for the net.
2. Officer Check-Ins
3. Short Time and Priority Check-Ins
4. All other Check-Ins
5. Announcements

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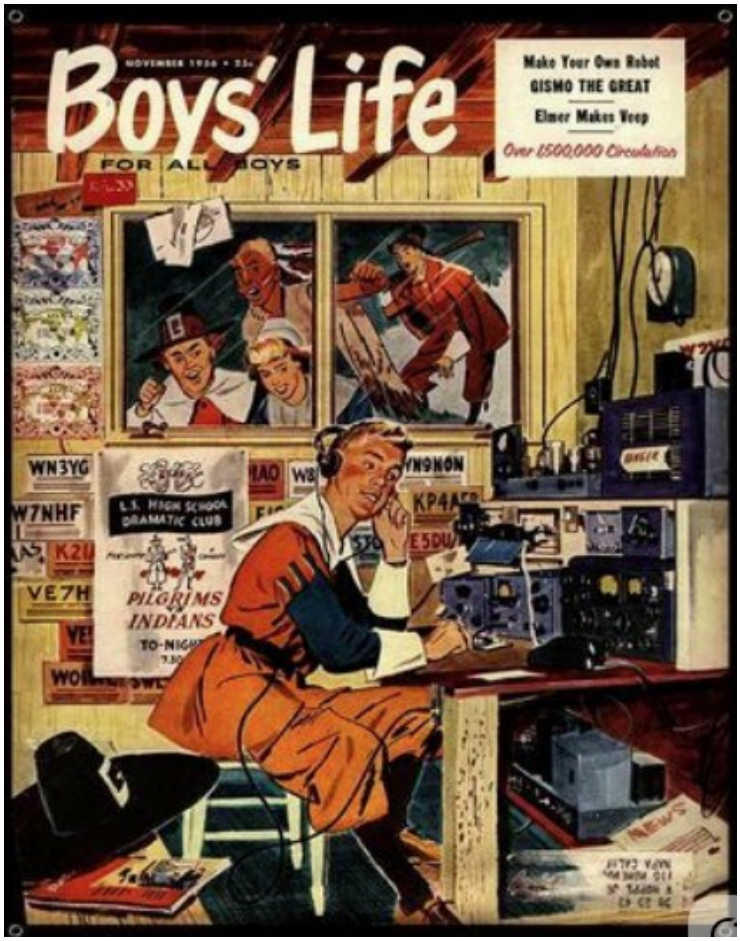
When the NCO calls for your group, key your mic (press the transmit button), say, “This is:” then un-key (release the transmit button) for just a second or two to make sure you didn’t “double with” (that is, accidently talk over) someone else. Then key back up and say your call sign, first name and city. The NCO will then call on you (usually) in the order that you checked in. At this point, you don’t have to say your call sign again, because the NCO just did. When you’ve finished speaking, give your call sign one last time.
If you have a lot to say, that’s OK, but you will need to un-key after about a minute. Simply announce, “break for time,” and release the talk button. Allow the squelch to go silent; this lets the repeater re-set, then key up and resume talking. If you don’t do this, the repeater will automatically cut you off after 2 minutes. Don’t worry, once you say “break for time,” everybody knows that you’re not finished and we’ll wait.

Here's a general rule: If you’ve got a question, ask. We all were beginners at some point. If you make a mistake, don’t worry, most people probably won’t even notice. Join in, enjoy yourself, and learn as you go. As much as the testing material gives dire warnings there is grace on the air as well

One more thing: Here’s how to avoid the mysterious disappearing syllable:
When you press your PTT button, several things happen very quickly: your radio switches from receive to transmit mode, and sends out a carrier wave. The repeater picks up your carrier and puts itself into transmit mode, sending out its own carrier wave. Everybody else’s radios pick up that carrier and open their squelch circuits so that we can hear you. All this happens very quickly, but not instantaneously – it takes between a half and 1 second usually. My recommendation is to key your mic, wait for your TX light to come on, and then take a breath before you begin speaking. That way, your first syllable or so won’t get cut off and your message will get through.

What are your thoughts on this? Please send your questions, comments, suggestions, tips, etc. to GCARC.wireless@gmail.com



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The Livonia Amateur Radio Club

Swap-n-Shop

Saturday

February 21, 2026

Sale Hours: 8:00 AM to 12 Noon

Absolutely no buying or selling before 8:00 AM

Buy, Sell or Trade
Amateur Radio Gear
ARRL Sanctioned
Volunteer Exam Session
by SLAARC

* ***Electronics***
* ***Antennas***
* ***Test Equipment***
* ***Computers***
* ***Ham shack accessories & more!***

SAME LOCATION!

Ward Church, Knox Hall
40000 Six Mile Road
Northville, MI 48168
West of Haggerty Road

Talk-In: K8UNS LARC Repeater
145.35 PL 100 Hz

Door Prizes from **ARRL**

· $100 Cash Grand Prize! ·

ADMISSION: STILL ONLY $5! (cash @ door)

Admission ticket pre-sales are available only to vendors/sellers with advance table purchases; visit the website for reservation info.

https://livoniaarc.com/larc-annual-swap-and-shop/

swap@livoniaarc.com

Phone: 734-648-6453

Same-day tables are subject to availability.