

## 2024-11-19 Hamlet Net - Radio Features (Squelch Systems)

### Announcements:

- Test Session Info
  - Next VE session is Saturday, December 14th in the Clover Building at the Boulder County Fairgrounds, and starts at 10 am. It is an ARRL session, so there is a \$15 fee to test. See the Licensing/Testing page on the club web site, <https://w0eno.org/>, under the Education menu.
- The November LARC General meeting is tomorrow, Wednesday, November 20th. Dave Vest from DX Engineering will be giving a presentation on DXCC (DX Century Club). The meeting will open with socialization at 6:30pm with the meeting itself beginning at 7pm. Attend in person at the Clover Building at the Boulder County Fairgrounds, or via Zoom.
- LARC's Santa on the Air will begin Friday, November 29th and run through Tuesday, December 10th. If you have anyone who would enjoy speaking to Santa, whether they are young or old, please help them get on the air during this event.

Also, if you are at all interested in being a Santa, Mrs. Claus, or an Elf / Net Control on a future Santa on the Air event, listen in this year to see how it's done.

This year, we are running the event for 14 days, which requires 28 volunteer hours on the air, so we're always looking for more help.

- Speaking of help, this weekend I attended a LARCFest planning meeting where some new ideas for the event were discussed. You know what I'm going to ask, but as this is the largest event the Longmont Amateur Radio Club puts on, we really need support from Club members to make it a success.

One of the new ideas is that instead of having presentations during the event, there will be an "Ask an Elmer" event where various experienced hams will be available via Zoom to answer your radio-related questions. So far, we have commitments from Dave Casler, KEØOG, and Kerry Brown, K5KAB. Now up to 6 Youtubers - Tom with Ham Radio A-Z, Steve - The Smokin Ape, Jim - WT1W from <something labs)

We are also planning to put together and sell 2m Yagi antenna kits. We'll be looking for volunteers to help put the kits together on January 11th from 9am to 1pm. If you're available and can help out, there is a sign up link on the Club's web page at:

[https://w0eno.org/other-clubs-and-radio-organizations/?sheet\\_id=17](https://w0eno.org/other-clubs-and-radio-organizations/?sheet_id=17)

- Christmas Party Dec 10 - sign-up link on web page ([https://w0eno.org/other-clubs-and-radio-organizations/?sheet\\_id=14](https://w0eno.org/other-clubs-and-radio-organizations/?sheet_id=14)). At the Grange in

Niwot. \$13/person. We are also looking for help setting up before and cleaning up after the event - you can sign up to help for one or both of these on the web page as well.

Food is from KT's BBQ and includes chicken, brisket, pork, green chili and baked beans. This is a potluck, so bring something to share (the first 4 to notify Dick can bring desserts).

For questions or more information, contact Dick, KE0VT, at: [gwabi2@hotmail.com](mailto:gwabi2@hotmail.com)

- Harbor Freight has a sale on the Apache 2800 weatherproof protective case. With coupon, the \$30 case is available for \$20, and can be used to hold and protect radio equipment. Looks like the other case sizes are not on sale at this time. A coupon can be found here: <https://go.harborfreight.com/coupons/2024/11/183220-58655/>
- If you are an experimenter, I noticed that Sparkfun has restarted local order pickup. This means you can bypass shipping fees on your orders, and can get products the same day if your order is placed by noon. Their web site is: <https://www.sparkfun.com/>
- Intrepid-DX Group is accepting entries for their Youth "Dream Big" essay contest. Entries are accepted from licensed hams aged 19 and younger. Prizes include an ICOM IC-7300, an ICOM ID5100AD dual band mobile radio with D-Star, and an ICOM IC-T10 dual band handy talkie. For more info, see: <https://forums.qrz.com/index.php?threads/youth-dream-rig-essay-contest-ends-november-30th.936093/>
- Upcoming Club Volunteer Opportunities:
  - Winter Field Day (Jan 25-26, 2025): [https://w0eno.org/other-clubs-and-radio-organizations/?sheet\\_id=16](https://w0eno.org/other-clubs-and-radio-organizations/?sheet_id=16)
  - LARCFest (April 5, 2025): [https://w0eno.org/other-clubs-and-radio-organizations/?sheet\\_id=15](https://w0eno.org/other-clubs-and-radio-organizations/?sheet_id=15) or contact Chuck at: [k0itp@w0eno.org](mailto:k0itp@w0eno.org)
- The CQ CW Worldwide DX Contest is this weekend. Even if you don't know or have any interest in CW, a big contest like this can be an opportunity to play around with the filtering settings on your HF radio. There will be a lot of CW traffic squeezed into the HF bands, so spend a little bit of time familiarizing yourself with your radios' capabilities - this will pay off for voice contacts in the future.
- The next RMHAM-U presentation is titled "Solar Power: Planning and Design" and will be held on December 21st from 8:30 am to noon-ish.

You can attend live in Greenwood Village at the Cherry Creek Schools ESC. It's also being held on Zoom if you can't make it, and they usually record the sessions for later

viewing as well.

To sign up, go to the RMHAM web site at: <https://www.rmham.org/> and click on the "Sign Up for RMHAM University" link under the "RMHAM UNIVERSITY" menu item.

- We have a new net on the LARC repeaters. It's run by Timothy Moss, KFØLAR, on the 22nd of every month at 6pm - that's this Friday. The 22nd was chosen to highlight the average of 22 vets who commit suicide each day. While the purpose of the net is to connect veterans, non-vets are welcome to participate as most all of us have friends or family who are or have served.
- ~~The ARRL Colorado Section Net occurs on the second Monday of the month from 7 to 8pm. The net is run by Amanda Alden, K1DDN, our Colorado ARRL section manager, and is open to hams and non-hams alike. This net is a place where Colorado hams can ask questions of ARRL leadership and request help, guidance, club support, and technical support. This net meets on the second Monday of each month at 7:00 pm Mountain time. The net is on the Colorado Connection, Rocky Mountain Ham Radio DMR Talk Group 700, The Fun Machine, WEØFUN, and the NCARC Buckhorn Repeater 447.700 with 100 Hz tone.~~
- We have some volunteer opportunities available where you can help out LARC:
  - Photographer / videographer - record team activities and upload to web site / YouTube
  - Newsletter Editor - put together the monthly Splatter newsletter
  - Event Coordinator
- You can start earning your 2025 membership or future renewal by acting as NCS for at least 5 nets this year. You can run either this Tuesday night net or the Thursday night net (or both). We have scripts available for both, so all you need is a good connection into the repeater, and somewhere to keep track of names and call signs as people check in. If you're going to be on the net anyway, why not save some dough at the same time! There are four free memberships available for 2023, so don't wait to get started!
- Chuck has set a goal for the Club of running at least one activity a month. This can be a hands-on construction activity, an operating activity like Field Day, a fox hunt, or a special event station. The goal is to get people together to have fun with amateur radio! We have multiple locations at our disposal, as well as lots of Club equipment, so if you have an idea for something you think others hams would like to do, please let us know, and if you're willing to run it, even better!
- The Club is also looking for presentation topics for 2024. If you have any ideas, or better yet, would like to present, please let Chuck know and we'll get you on the schedule!

- All club activities are open to anyone - members and non-members. If you have questions, ask them on a net or **send email to [elmer@w0eno.org](mailto:elmer@w0eno.org)**

**Presenter: Bryan, AF0W**

**Topic: Radio Features (Squelch, CTCSS, DCS)**

- This week is a continuation on features frequently found on HT and mobile radios, and covers different squelch systems on radios

### **Squelch Systems**

- In broad terms, squelch is the suppression of undesired noise or audio on a radio receiver
- Due to various sources of background noise (collectively referred to as the noise floor), radio frequencies are generally not quiet
- Typically, users don't want to be constantly exposed to this noise!
- Modern radios have multiple systems in place to address this issue

### **Carrier Squelch**

- The simplest of them is called carrier squelch (or just squelch)
- The radio will suppress audio output until the signal level crosses some threshold limit
- On some radios like the Yaesu FT-60, this level is adjustable via a rotary knob. On others such as the Baofeng UV-5R, the adjustment is made via a menu setting.
- To set the level, you wait until there is no signal present on the frequency, adjust the squelch level down until you hear static, then adjust it back up until the static stops.
- You may need to change this level occasionally if the local noise level increases.

### **CTCSS**

- CTCSS stands for Continuous Tone-Coded Squelch System and instead of triggering off the signal strength, it uses a continuous, sub-audible tone to enable the receiver's audio
  - It was invented in the 1950s by Motorola for their Land Mobile Radio system as a way to get more than one Land Mobile user on the same frequency
- The tones consist of around 55 frequencies in the range of 67 Hz to 250 Hz
- It is sometimes also referred to as "tone squelch" or "PL" (private line)

- Radios contain filtering circuits to remove the tones from the audio they output
- If you enable CTCSS on your radio, then you will only hear transmissions that include the tone you configure
- Note that users with whom you communicate (both via repeaters and directly via simplex) will need to configure their radios to send the correct tone
- This functionality is sometimes referred to as "privacy codes" on FRS radios, but it actually does not provide any privacy whatsoever
  - Your transmission will only be blocked from other users who have their radios set to use CTCSS, and who have a different tone configured
  - Users with CTCSS disabled will be able to hear the transmission just fine (as will users with the same CTCSS tone selected)
- This feature is typically used on repeaters - for example, LARCs 2m repeater requires a 100 Hz tone to repeat a transmission. It also adds a 100 Hz tone when transmitting, so you can enable CTCSS on your radio.
- The primary purpose of the CTCSS tone on a repeater is to prevent a repeater from inadvertently retransmitting traffic meant for a different repeater that shares the same frequency.
  - Generally, the frequency coordinating body will attempt to avoid assigning the same frequency to multiple repeaters in the same area, but due to limited frequency availability, this is not always possible.
  - For example, our 70cm repeater frequency of 448.800 MHz is also assigned to a repeater in Colorado Springs, but each repeater has a different CTCSS tone frequency - 88.5 Hz for LARC, and 100.0 Hz for Colorado Springs.
- It is also possible to have a "split tone" setup - in this case, your radio transmits using one tone, and uses a different tone for CTCSS on the receiving side.
  - An example of this are the repeaters on the Colorado Connection.
  - They require an 88.5 Hz input tone, and transmit with a 123.0 Hz output tone
- Early radios did not have easily-changeable tones - they used plug-in modules, each tuned to a specific CTCSS frequency
  - Some radios did not even support CTCSS at all
- Note that even if a repeater is transmitting a tone, you do not have to use CTCSS on your radio (unless you are within range of another repeater on that frequency)

- You do have to transmit a tone to use a repeater if it uses an input tone

## **DCS**

- DCS stands for Digital Coded Squelch and instead of a single tone, it utilizes a continuous, sub-audible, slow-speed, three-digit binary data stream that includes error correction capabilities.
- The data is sent as a 23-bit message at 134 bits per second
- Also referred to as "Digital Private Line" (or DPL)
- A benefit over CTCSS is that it supports over 100 codes (all codes cannot be used due to the protocol involved)
- Many old radios will not support DCS, so if this is required by the type of operating you plan to do, you should probably look for a more recent device
- DCS is not highly-used in Colorado - out of 298 coordinated FM repeaters, there are 263 using CTCSS and only 3 using DCS

## **Tone Calling - 1750 MHz tone**

- You may also see reference to something called "tone burst" or "tone calling"
- This is a system used primarily in Europe where a repeater needs to receive a short tone of 1750 Hz prior to enabling the transmitter
  - The tone does not get transmitted continually with speech, as it does for CTCSS
- Some satellites use a similar system
  - For example, SO-50 requires a 74.4 Hz PL tone which activates a 10 minute timer, then requires a continuous 67 Hz tone for normal operation

## **Tone/Code Scanning**

- If you are in a new area and don't know the CTCSS frequency or DCS code for a repeater, many radios can scan for the values
- Some repeaters do not transmit tone / DCS, but do require it - in these cases, you would have to be able to receive the signals on the repeater input to be able to determine the codes

## **Monitor Function**

- Most HTs include a monitor function. When enabled, this feature removes all squelch from the receive audio path

### **Multiple User Interference on Frequency**

- Note that the use of CTCSS or DCS does not prevent you from interfering with another user on that same frequency
  - It just adds "selective earplugs" - the interference is still there!
- For example, if you are in an area where there are multiple repeaters sharing a frequency with different tones, and you have CTCSS enabled, you should use the monitor function to check to make sure the frequency is not busy before transmitting
- I also ran into a situation on a recent net where I heard interference on my signal when attempting to transmit into the 70cm repeater. I quickly switched to the 2m repeater, and when I later checked back on the 70cm repeater, the interference was gone.
  - The interference sounded exactly like when someone doubles on your signal - a buzzing, static sound.
  - What was likely happening was that someone was attempting to transmit into the 70cm repeater, but either did not have their radio configured to transmit a tone, or it was transmitting the wrong tone.
  - Because of the lack of correct tone, I (and others on the net) did not hear them, but when I attempted to transmit during their transmission, we doubled.
  - If they were within direct range of my station, I could have switched my radio to listen on the 70cm repeater input frequency, and would have heard them.

### **Final Words**

- When working satellites, it's a good idea to disable all receive squelch as it makes it easier to hear when the satellite comes into view
- The digital squelch levels on the Baofeng UV-5R and UV-82 are known to have issues right from the factory.
  - Changing the squelch setting in the menu does not have much of an impact
  - You can change the internal settings for the 9 squelch levels to be more reasonable using CHIRP
  - Search Google for "miklor baofeng squelch" - the first result details the issue and how to go about addressing it

- Some radios (especially Baofengs) have a relatively long delay when activating the speaker using carrier squelch. If you are attempting to use a mode such as SSTV or APRS / packet, you should disable carrier squelch or you may miss the beginning of every packet.
- HF radios typically support carrier squelch, but it is not often used as you are frequently listening for very weak signals in the noise

### Questions:

1. **The question for the week is:** What are your most memorable experiences involving amateur radio?
2. **In my case,** there were two very memorable contacts. Well, the first wasn't exactly a contact, but rather an APRS packet sent from my station and received by the International Space Station. I sent the packet from my home station fairly soon after I was licensed, and it reminded me of all the old Star Trek episodes I grew up with. I just couldn't believe I was able to send information up to something orbiting in space.

The second contact was my first HF DX contact. This was a digital contact using JT65, which is an older protocol within the WSJT-X software. It is a weak signal mode similar to FT8, but the transmit and receive times are 1 minute each, versus 15 seconds with FT8. This was the first digital mode I used on HF, and while I made a number of contacts in the continental US, my first contact outside the US was really neat. Unfortunately, I have my old logs stored on an old PC, so I'm not able to find the country at the moment, but I think it was in the Caribbean.

### More Info:

- Colorado Council of Amateur Radio Clubs (Colorado frequency coordination): <https://www.ccarc.net/wordpress/>
- A Historical Technical Overview of Squelch Systems: <https://www.repeater-builder.com/tech-info/ctcss/ctcss-overview.html>
- Digital-Coded Squelch: [https://www.sigidwiki.com/wiki/Digital-Coded\\_Squelch\\_\(DCS\)](https://www.sigidwiki.com/wiki/Digital-Coded_Squelch_(DCS))
- Continuous Tone-Coded Squelch System: <https://www.sigidwiki.com/wiki/CTCSS>

### Notes:

- If you have ideas for net topics or general meeting topics / presenters, please let us know! Tell us on a net, or send email to [k0itp@w0eno.org](mailto:k0itp@w0eno.org)

Email to [elmer@w0eno.org](mailto:elmer@w0eno.org)

1. K0ITP - Chuck - Firestone



2. WA0JJC - Bob - Boulder
3. KF0QMP - Aki - Longmont
4. AF0W - Bryan - Longmont

**End:** 7:50pm