

## 2023-10-03 Hamlet Net - Radio Features (Squelch, CTCSS, DCS)

### Announcements:

- Test Session Info
  - Next VE session is Saturday, October 29th in the Clover Building at the Boulder County Fairgrounds, and starts at 10 am. It is an ARRL vEC session, so there is a \$15 test fee. For more info, and to pre-register, see the Licensing/Testing page on the club web site, <https://w0eno.org/>, under the Education menu.
- LARC will be conducting its annual meeting on October 18th. Elections for the Board of Directors will be held that night, so all LARC members please plan to attend (at least for the voting at the beginning of the meeting, as we have to get a quorum of members present to conduct the elections). If you are unable to attend in person or via Zoom, please submit a proxy to help us meet the quorum requirements.
- We have some volunteer opportunities available where you can help out LARC:
  - Photographer / videographer - record team activities and upload to web site / YouTube
  - LARC Fest Coordinator -
  - Newsletter Editor - put together the monthly Splatter newsletter
  - Activities Chairperson - member of the Board of Directors
- Our sister club up in Nederland is looking for some help with events they are running. They have a weekly Monday night net with no predetermined agenda, so you can lead it however you want. They are also planning a Field Day site at Golden Gate State Park and are welcoming anyone who wants to participate. Finally, they are looking for operators for the Ned Gravel run on July 8th. They have signup links for all these events, so head over to their web site <https://w0ned.org/> for more information!
- You can start earning your 2023 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 2023. 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
- 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, I**

#### Backup Questions:

1. What hobbies do you have other than ham radio? Do you (or could you) use ham radio in these hobbies?
2. Share an "a-ha" moment you had with amateur radio?

#### 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>
- 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)

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