

# Brass Tacks



Technically speaking, an in-depth look at a radio-related topic

## Repeater tones

As you've no doubt discovered by now, our club (146.780 MHz) repeater, requires a *tone* to make it transmit for you. At the same time, without setting this feature, you can still hear others transmit through the repeater, so what gives? I guess the real questions are, what's a repeater tone, and why should you care?

A repeater tone is nothing more than a constant *hum* at a particular frequency; in the case of our club repeater, 100.0 Hz. We refer to this frequency as a *sub-audible tone*, even though it's well within the human hearing range, because our receivers are built to filter out all frequencies below 300 Hz.

## How it works

If your transceiver is programmed correctly for the club repeater, as soon as you press your PTT button, your transceiver will generate this 100.0 Hz hum and mix (*encode*) it with your voice, combine (*modulate*) this mixture with a 146.180 MHz *carrier* signal (another simple hum, only much higher in frequency, and *offset* -0.600 MHz from the repeater output frequency), then transmit the combination out through your antenna.

The repeater will pick up your transmission (because it's listening for the 146.180 MHz carrier), un-combine (*demodulate*) the signal, determine whether the 100.0 Hz tone is mixed in with the voice (*decode*), then turn on (*open*) its transmitter continuously while it detects the 100.0 Hz tone in the incoming signal.

If the repeater picks up your transmission at 146.180 MHz, but finds no 100.0 Hz tone mixed in with the signal, the repeater will simply not open the transmitter, which is why nobody can hear you through the repeater if you don't have the tone set correctly. But since the tone is only for you to transmit, you can still hear the repeater whether or not your tone is set.

## Hmmm...

The frequency of this hum is intentionally greater than 60 Hz so that house current or mains hum doesn't accidentally get sent by you to open a repeater, and less than 300 Hz so that we can hold a voice conversation with reasonable sound quality. Today's repeaters typically use one of two types of tone systems: [CTCSS](#) (Continuous Tone-Coded Squelch System) or [DCS](#) (Digital-Coded Squelch). CTCSS has also been known by other names, such as *PL* (trademarked by Motorola), *Channel Guard* (trademarked by GE), and *Quiet Channel* (trademarked by RCA.)

While not fool-proof, one (probably the major) purpose for a repeater requiring a tone is to prevent re-transmitting unintentional signals (interference) from static discharge, electrical equipment, or other nearby repeaters.

## TSQL (tone squelch)

Finally, some repeaters will also encode the signal they re-transmit with a tone, and if you've programmed your transceiver for *tone squelch*, it'll squelch all audio whose original signal was not sent from the repeater encoded with the tone.

— Noji Ratzlaff, KNØJI ([kn0ji@arrl.net](mailto:kn0ji@arrl.net))