CTCSS - More than you wanted to know. . .

As the name implies, Continuous Tone Coded Squelch System (CTCSS) is a continuous tone that is so low in frequency and volume that it is almost impossible to hear with the un-aided ear. This sub-audible tone is sent over the air along with the audio to the receiving station. The receiver has a circuit that detects this tone. The CTCSS equipped radio doesn't let any sound through to the speaker until it hears the specific tone it was programmed to listen for. This allows many users to be on one frequency without causing interference to more distant stations using different sub-audible tones. This is sometimes referred to as tone squelch. When more than one user group is on the same channel (called *co-channel users*), CTCSS keeps other users from being heard if they are using a different CTCSS tone or no CTCSS at all. Note that the receiver is still receiving radio signals but the CTCSS circuit acts like a switch and doesn't let any sound through until it detects the right tone. Receivers equipped with a CTCSS circuit usually have a button or menu item to turn this function on and off. When a receiver is not using CTCSS, it is referred to as operating in carrier squelch or noise squelch mode.

As a simple example: suppose a radio frequency is shared by two groups of users, Group A and Group B. Conventional radios without CTCSS would hear all transmissions from both groups. Both groups would have to listen to each other's transmissions. If both groups were to use CTCSS units then each group would only hear radio signals from their own group. This is supposed to reduce missed messages and the distraction of unnecessary radio chatter.

Note that in the example above there are only two co-channel users. In dense radio environments a large number of groups may be present on a single radio channel. Also note that anyone listening to the channel with a non-CTCSS equipped radio will hear everything. CTCSS doesn't make it private as FRS radios advertise.

One of the disadvantages of using CTCSS on shared frequencies is that since users cannot hear transmissions from other groups, they may assume that the frequency is clear when it is not. They could possibly transmit simultaneously with another user, thus accidentally overriding or interfering with the other group's transmissions. This could result in one or both not being clearly understood. The more groups that share a single frequency, and the more frequently that they transmit, the more likely that this accidental interference will occur. In commercial service a transmit button interlock is required by the FCC so that a station must first listen to the frequency before transmitting.

The process of sending these tones is commonly referred to as **ENCODING**. CTCSS encoding continuously superimposes any one of 32, 38 or 40 tones (depending on which "standard" is used) on the transmitted signal The tones range from 67 to 257 Hz. CTCSS tone level would normally be set to only 750 Hz deviation where normal voice is set from 3.5 to 5KC deviation.

The process of detecting a carrier with the correct CTCSS tone is called **DECODING.** .

There is another common system called Digital Coded Squelch, **DCS** (Motorola's name is DPL for Digital Private Line, GE calls it Digital Channel Guard). This system uses digital number codes transmitted continuously in much the same way as CTCSS to accomplish the same end. Digital codes add another 200+ choices to the signaling codes, There are several other types of tone calling systems in use: Tone burst or single tone; DTMF (dual tone multi frequency); Selcal (selective call) and several other proprietary systems.

CTCSS is probably the most commonly used signaling system used in Amateur Radio. The next most commonly used is DTMF (telephone keypad tones) and these are mainly used to control repeater functions remotely. DTMF tones are usually muted to keep the code sequences somewhat private.

Common CTCSS Tones (NS=non standard #, PL=Motorola code#)

NS	PL	Hz	NS	PL	Hz	NS	PL	Hz
1	XZ	67.0	13	1A	103.5	26	5B	162.2
	WZ	69.3	14	1B	107.2	27	6Z	167.9
2	XA	71.9	15	2Z	110.9	28	6A	173.8
3	WA	74.4	16	2A	114.8	29	6B	179.9
4	XB	77.0	17	2B	118.8	30	7Z	186.2
5	WB/SP	79.7	18	3Z	123.0	31	7A	192.8
6	YZ	82.5	19	3A	127.3	32	M1	203.5
7	YA	85.4	20	3B	131.8	33	M2	210.7
8	YB	88.5	21	4Z	136.5	34	M3	218.1
9	ZZ	91.5	22	4A	141.3	35	M4	225.7
10	ZA	94.8	23	4B	146.2	36	M5	233.6
11	ZB	97.4	24	5Z	151.4	37	M6	241.8
12	1Z	100.0	25	5A	156.7	38	M7	250.3

Other brand Names for CTCSS

CTCSS is often referred to as *PL* (for *Private Line*, a trademark of Motorola). General Electric's and Bendix King's called it *Channel Guard* (or *CG*), Vintage RCA radios called it *Quiet Channel,* Icom radios called it *C.Tone,* Kenwood radios called it *Quiet Talk* or QT. Johnson used "TG" for "*ToneGuard*", and later "CG" for "*CallGuard*". Zetron literature refers to "*ToneLock*". There are many other company-specific names used by radio vendors to describe compatible systems.

Any CTCSS system that uses compatible tones is interchangeable. Old and new radios with CTCSS and radios from different manufacturers are also compatible. Most amateur radios use the tones listed above.

CTCSS is very commonly used in amateur radio for the purpose of hiding interference. Very wideband, and extremely sensitive radios are common in the amateur radio service. These wideband radios can be bothered by strong adjacent-channel signals. CTCSS is also often used for all repeaters in a geographical region. They may all have the same CTCSS tone as a method of reducing on-channel interference from adjacent regions. This allows the reuse of the same frequency in closer spaced areas. Some radio clubs use the same tone on all of their club repeaters to make them easier to remember.

It is a bad idea to use any coded squelch system to hide interference issues in systems especially with life-safety or public-safety uses such as police, fire, search and rescue or ambulance company dispatching. Adding tone or digital squelch to a radio system doesn't solve interference issues, it just covers them up.

For a more detailed explanation of CTCSS go to http://en.wikipedia.org/wiki/CTCSS