

How do I?

An occasional series

This week: **PL, DCS, CTCSS and DTMF** and their role in FM repeaters

PL, DCS, CTCSS and DTMF: what do they mean and what do they do?

Radios To Go! written by Steve Ford, WB8IMY, and published by ARRL (2012) gave the name “Alphabet Soup” to the chapter on these well used FM VHF features.

We took a very brief look at PL tones in <https://www.radioclub-carc.com/wp-content/uploads/2020/06/How-Do-I-FM-Repeaters.pdf> as a part of the *How Do I...?* series

CTCSS or **Continuous Coded Tone Squelch System** is the present version of the original Motorola Private Line or PL, developed after WWII.

CTCSS uses a number of predefined sub-audio frequencies (specified in Hertz) to transmit a tone along with your voice. This sub-audio tone tells the repeater you want to talk on it. If you do not transmit the tone, the repeater will not “open” and receive and retransmit your signal. At this point, PL and CTCSS are the same other than trademark or brand name considerations.

VALID MOTOROLA PL CODES

XZ 67.0	WZ 69.3	XA 71.9	WA 74.4	XB 77.0	WB 79.7
YZ 82.5	YA 85.4	YB 88.5	ZZ 91.5	ZA 94.8	ZB 97.4
1Z 100.0	1A 103.5	1B 107.2	2Z 110.9	2A 114.8	2B 118.8
3Z 123.0	3A 127.3	3B 131.8	4Z 136.5	4A 141.3	4B 146.2
5Z 151.4	5A 156.7	5B 162.2	6Z 167.9	6A 173.8	6B 179.9
7Z 186.2	7A 192.8	M1 203.5	8Z 206.5	M2 210.7	M3 218.1
M4 225.7	9Z 229.1	M5 233.6	M6 241.8	M7 250.3	0Z 254.1

Codes shown in **red** are not standard and are not recommended.
Codes above 200 Hz may be audible and are not recommended.

From <http://www.repeater-builder.com/tech-info/pl+dpl/pl+dpl.html> 12/20/2020

The repeater will be set up to listen for one of these CTCSS tones, for example 100.0 Hz. When the repeater hears its own designated tone on its INPUT frequency, it will begin transmitting whatever it hears on its OUTPUT frequency.

The use of CTCSS or PL Tones can be part of a frequency management program. Distant repeaters, located beyond the normal transmission range of your local repeater, and sharing the same RF frequency as your local repeater, may occasionally pick up transmissions intended for your local repeater. The assignment and use of different CTCSS or PL tones for each neighboring shared-frequency repeater will minimize the possibility of unintended interference.

DCS or **Digital Code Squelch** is a newer system used on some repeaters. The operation is the same as CTCSS but the tones are different.

VALID MOTOROLA DPL CODES												
Ø23	Ø25	Ø26	Ø31	Ø32	Ø43	Ø47	Ø51	Ø53	Ø54	Ø65	Ø71	Ø72
Ø73	Ø74	114	115	116	122	125	131	132	134	143	152	155
156	162	165	172	174	2Ø5	212	223	225	226	243	244	245
246	251	252	261	263	265	266	271	3Ø6	311	315	325	331
343	346	351	364	365	371	411	412	413	423	425	431	432
445	446	452	455	464	465	466	5Ø3	5Ø6	516	521	525	532
546	552	564	565	6Ø6	612	624	627	631	632	645	652	654
662	664	7Ø3	712	723	725	726	731	732	734	743	754	

Codes shown in **red** are not standard and are not recommended.

<http://www.repeater-builder.com/tech-info/pl+dpl/pl+dpl.html> 12/20/2020

DCS can also be used to set your radio to receive only when your station is being called. Let's say there is a frequency your club regularly uses, but you only want to listen when you are called. Most newer VHF/UHF radios support DCS. You select a tone (see list) and tell your friends -- If they transmit your tone on the "club" frequency and if your radio is on, your radio will wake up and begin receiving.

DTMF or Dual Tone Multi Frequency

was developed by Western Electric in the 1960s and is at the heart of the Touch Tone Telephone System. Clever folks began using this technology in commercial and then amateur radio systems. If you recall the NBC TV show “Emergency” from the early 1970s, every time they were called out, a DTMF tone was activated by the dispatcher. The tone turned on the station loudspeaker so the on-duty crew knew where to go.



Yaesu MH48 DTMF mic as used on the Yaesu FT8900 transceiver, and others.

DTMF is used in amateur radio for telephone autopatch, where you use your radio to call a repeater and the radio signal becomes a phone call. Before widespread availability of cell phones this was pretty common practice in urban areas.

DTMF is widely used in applications from turning on the lights at helipad (the crew dials the DTMF tone as they approach and the lights come on) to railroads changing the position of a track switch. The train crew dials the DTMF tone and the switch changes position and usually has an illuminated light and a radio broadcast to tell the crew it functioned.

DTMF is used in amateur radio to among other things, activate ECHOLINK nodes.

Please see <https://www.radioclub-carc.com/wp-content/uploads/2020/06/How-Do-I-Tower-of-Babel-IRLP.pdf>

How do you keep all this straight? Most modern radios have memory channels. The CTCSS, DCS and DTMF tones can be stored in memory. The appropriate software from RT Systems (see elsewhere in this series for several articles) or CHIRP and the radio specific cable makes programming and using these codes very simple.

The Repeater Directory lists the tones needed for a specific repeater.

Catch ‘ya on the air!