Kapiti Amateur Radio Society Inc. Branch 69

On the care and feeding of the CS-700 handheld
By Jeff Graham ZL2JG

Introduction

The CS-700 is a 70cm band handheld that supports traditional analog FM and the new digital ETSI DMR standard available from more than a half dozen manufacturers. DMR is sometimes called MotoTRBO by Motorola users.

CS-700 Operation

Turning on / off

The on / off and volume control is the knob on the top of the right hand side of the radio. Turn it clockwise to turn on and adjust the speaker volume, counter clockwise until it clicks to turn off.

Transmitting

Press the blue PTT switch on the side of the radio, if you hear an access permit tone – two short musical notes, you are successfully accessing the repeater and the timeslot/talkgroup (together these form a virtual channel) you need is available. If you hear no tone or a long steady single tone, either you are out of range of the repeater or it is busy. Before transmitting check the display – this will show the repeater and talk group you will transmit to.
The CS-700 has a bit of a reputation for having low transmit audio levels. It is necessary to speak directly in to the mic (just above the top left corner of the display) with the radio held close to the mouth. If you speak at it like you would a cell phone from 20cms then the TX audio will be very low.

LED

There is an LED in front of the volume control knob. It goes green if one or more talkgroups on the repeater is active, although you will hear no audio if the active talkgroup is not the one you currently have selected. It goes red when you transmit.

Changing channels

The channel selector is the centre knob on the top of the radio. It has 16 positions. The currently selected channel is displayed on the LCD screen. The channels are a combination of repeater, timeslot and talk group. Each repeater supports two timeslots (two independent conversations) and multiple talk groups.

Changing Zone
Channels are organised in to zones (banks) of channels. The zone is changed via the keypad.

- Press the right arrow key "**>**" several times until the screen displays zone
- Press key "**O**" for OK
- Press the left or right arrow key "**<**" or "**>**"until the name of the desired zone is displayed
- Press "**O**" for OK or "**C**" to cancel.

Note – there is a 'feature' in the CS-700 in that it will ignore the keypad if the currently selected timeslot is active, in other words you can't change zone while a QSO is in progress.

Other Buttons

There are two smaller buttons on the side below the **blue PTT** and an **orange button** on the top. They have different functions for short press – half second or less, or long press – 1 second or longer.

Lower side button - short press does nothing while a long press causes transmissions to be on the repeater output frequency rather than the input. This can be useful for testing or for simplex communication when out of range of the repeater.

Middle side button - short press toggles channel scanning on or off while a long press toggles between low and high power TX:

- When scanning you will see a symbol like a capital **Z** with an arrow head in the centre of the upper row of the display
- TX power is indicated by an **H** or **L** in the upper row of the display

Orange top button short press toggles monitor on or off, long press toggles squelch sensitivity:

- Monitor is only used in analog FM mode and opens the squelch regardless of signal level
- Squelch sensitivity is more sensitive by default, can be toggled to less sensitive if in an electrically noisy location

Display
The display shows the repeater and talk group selected on the left hand side of the lower line. When the receiver is active either the name and call sign of the active station is displayed on the upper line, or their ID code is displayed. The radio contains a table of known IDs and names/calls but there is not space in the table for all known IDs – there are over 40000 registered IDs. The radios do have all known ZL IDs, but the table needs to be periodically updated to add newly registered users. If an ID is not in the table then the ID is displayed instead of the name and call sign.
Signal strength is shown on a small bar graph on the left of the top line.
Battery level is shown on the right of the top line.

Charging

Charge in the supplied charger stand using the supplied adapter. The recommendation from Connect Systems is to switch the radio off before inserting it in to the charger.

DMR Concepts

Zones

Zones are banks of channels and currently are set up and named by the **repeater location** that they support.

Colonial has been replaced by Porirua.

Porirua is the same site but has the new frequency .

Wairarapa is the Masterton DMR repeater, currently at the Masterton branch clubrooms**.**

Kapiti is the Kapiti DMR repeater on Mt Field**.** Covers the Kapiti Coast south to Pukerua Bay and north along SH1 to Bulls. Coverage in Palmerston North is patchy.

Wellington is on Wrights Hill and provides coverage in to Wellington CBD and the Hutt Valley

Wellington STSP is a DMR STSP repeater run by the Wellington VHF Group.

Waikato is the DMR repeater in the centre of Hamilton**.**

Dunedin is the Highcliff repeater

Tasman is located on the Takaka Hill.

Manawatu is on the Pahiatua Track Road above Palmerston North

Auckland is on Quinns Rd in the Waitakeres

Christchurch is on the gondola building on the Summit Rd.

Tauranga located ???.

Marlborough not yet on the air, site still tbd, looking to cover Blenheim and SH1 south towards Kaikoura

Taranaki not yet on the air, site on Mt Taranaki tbd

Whangarei not yet on the air, coverage of Warkworth to Whangarei along SH1

6875 / 7000 / 7125 etc are generic DMR channels on frequencies put aside by FMTAG that future repeaters will be assigned for operation. They are included so that a radio does not have to be immediately re-programmed to access a new repeater.

Analog Upper North, **Analog Lower North** and **Analog South Island** contain the regular analog FM 70cm repeaters for the whole country, split in to 3 groups

National System has the analog National System frequencies - as the number of NS repeaters exceeds the number of channels that fit in a single zone, the channels are identified by frequency only eg 9925 would be used for Kapiti, Whangarei, Rangitoto, Rotorua, Nelson and Dunedin NS nodes, except where CTCSS use requires a dedicated channel, eg ChCh

STSP DMR has the national AREC STSP repeater frequencies.
STSP Analog has the same set of frequencies but programmed for analog operation

Talk Groups

In each DMR repeater zone, the first eleven channels are the eleven talk groups that are carried on that repeater. These are

ZL (TG530) is a nation wide talk group carried on all ZL repeaters but does not go to VK. Introduced to provide a nation wide channel that does not also tie up the Aussie repeaters. This is the main calling channel for local contacts.

ZK (TG8) is a second nation wide talk group carried on all ZL repeaters. It differs from ZL in that it is carried in timeslot 1 not timeslot 2, thus ZL and ZK can be in use simultaneously. It is intended primarily for national AREC use but is available for general use if TS1 is not busy.

LCL which is carried only on the NZ repeaters and is local to a master repeater and its peers.   It can be used for very long QSOs to avoid tying up all ZL repeaters for the duration of the QSO.

WW is the original World Wide talk group (TG1), primary language is English but you will hear QSOs in other languages.   It should only be used as a calling channel then QSY to one of the UAE groups for a longer QSO.

WWE (TG13) is the World Wide English language talk group. Like WWE it should be used primarily as a calling channel for international contacts.

UAE1 and **UAE2** are the so called 'user access' groups. These are intended as overflow groups for **WWE**. They differ in that use of **WWE** keys up over a thousand repeaters world wide and ties up the timeslot that it is carried in for the duration of the QSO on *all* those repeaters. **UAE1** and **UAE2** only key up the local repeaters at each end of the QSO and free up the timeslot on the rest of the network. The idea is that you would make contact on **WWE** then QSY to **UAE1** or **UAE2** if you are going to have a long QSO. **UAE1** and **UAE2** are intended for English language contacts.

AT is the Audio Test talk group. It used to be used in conjunction with the CAL DMR website http://norcaldmr.org/listen-now/   however this site now appears to be offline and I have been unable to find an alternative. A transmission in AT will be heard on that web site and a VU meter will display audio levels. *Note the web site only works with the Chrome browser* and also note that it takes around 25 seconds for the audio to be processed and output.

DMRplus SP   This links to the DMRplus network South Pacific talk group. It is a "PTT mode" talk group. That is, the audio from this source is muted until your local repeater is keyed using this talk group. At that point audio from **WW** and **WWE** is muted and audio from **DMRplus SP** is enabled, and will remain enabled for 10 minutes after the last time the TG is keyed locally.

DMRplus US   This links to the DMRplus network North American talk group. It is a "PTT mode" talk group. That is, the audio from this source is muted until your local repeater is keyed using this talk group. At that point audio from **WW** and **WWE** is muted and audio from **DMRplus US** is enabled, and will remain enabled for 10 minutes after the last time the TG is keyed locally.

DMRplus UK   This links to the DMRplus network UK talk group. It is a "PTT mode" talk group. That is, the audio from this source is muted until your local repeater is keyed using this talk group. At that point audio from **WW** and **WWE** is muted and audio from **DMRplus UK** is enabled, and will remain enabled for 10 minutes after the last time the TG is keyed locally.

Basic DMR Concepts

The DMR system is based around the idea of 'talk groups'. These can be thought of as virtual channels. Some are regionally based, others are carried worldwide. Only a limited number are carried on a given repeater.

All ZL repeaters currently carry

- TG1   **WW** (worldwide) as its name suggests, intended as a calling channel and for short worldwide contacts, primarily in the English language - please avoid long QSOs on this busy channel
- TG9   **LCL** (local) only carried on the local cluster of repeaters, does not go to Australia or rest of world – not used very much at the moment
- TG530 **ZL** uses TS2, linked across all ZL repeaters, Primary channel for local QSOs
- TG8   **ZK** uses TS1, linked across all ZL repeaters, is not linked to VK or DMR-MARC core
- TG13   **WWE** (worldwide English) primary calling channel for worldwide English language contacts between regions – use this in preference to WW.
- TG113 and TG123 **UAE1** and **UAE2** – PTT activated overflow groups for WW and WWE
- TG9999 **AT** Audio Test
- TG133   **DMRplus US** – PTT activated connection to DMRplus network North American talk group
- TG143   **DMRplus UK** – PTT activated connection to DMRplus network United Kingdom talk group
- TG153   **DMRplus SP** – PTT activated connection to DMRplus network South Pacific talk group

Each repeater has two timeslots.

All NZ repeaters use timeslot 1 to carry **WW, WWE, UAE1, UAE2, DMRplus US, DMRplus UK**, **DMRplus SP** and **AT** (the international talk groups) as well as **ZK.**

Timeslot 2 carries **LCL** and **ZL** (the local / regional talk groups).

Both timeslots can be used at the same time, so one ZL station could be working an international contact while a second ZL station is talking locally.

In a given timeslot, only one talk group can be active at a time, so if **WWE** is active you cannot make a call in **WW** at the same time.

Etiquette

Check the busy LED on the radio before transmitting for the first time. If it is green, the repeater is currently active on one or more talk groups and your call might interrupt another local user in a different talk group to the one you have selected. Step around the channel selector switch to find out where the activity is, or check the netwatch page if handy, to make sure you don't interrupt a QSO already in progress.

When making a call you do not need to call CQ, just announce yourself and it is normal on the initial call to say which talk group you are calling in – this helps someone who is scanning channels to go back to the correct channel to reply your call. Eg "ZL2XYZ listening worldwide English" or "ZL2XYZ listening TG13". Most people reference the talk groups by name not number.

Keep contacts in TG1 / **WW** and TG13 / **WWE** short, they are intended primarily as a calling channel.

Use **WWE** for international QSOs and QSY to **UAE1** or **UAE2** if it is going to be a long QSO
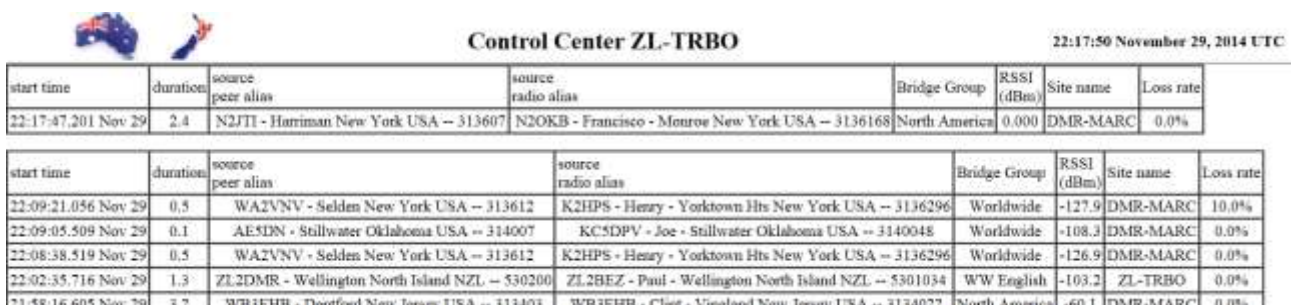
In addition to the access permit tones at the start of an over, you will hear a channel free tone at the end of each over. As DMR repeaters have no audible 'tail' this is the indication that you can transmit now but please remember to leave a few seconds gap, particularly on **WW** or **WWE** so other stations can break in if necessary.

The **UA** and **DMRplus** groups are set up in "press to talk" mode. That is to say that the audio from those groups is not connected to your local repeater until you trigger your local repeater using that talk group ID, so you must trigger your repeater with the correct talk group ID set at least once to hear the overseas station, and he needs to do the same at his end. When changing from **WW** or **WWE**nglish to one of the **UA** groups, I find it best to "kerchunk" the repeater once on the **UA** group channel to activate the connection, then put out a call for the other station.
Once activated, the **UA or DMRplus** group has exclusive use of time slot 1 for the next 10 minutes and audio feeds from all other TGs that use time slot 1 are muted for that duration. Each time you transmit locally you re-start the 10 minute timer so you retain use of the group for the duration of your QSO.

Useful Links

http://trbo.arec.info:42420/MinimalNetwatch this is the ZL-TRBO C-Bridge site that controls operation of the NZ DMR repeaters and allows you to see the activity going on in real time:

			Control Center ZL-TRBO				22:17:50 November 29, 2014 UTC

start time	duration	source peer alias	source radio alias	Bridge Group	RSSI (dBm)	Site name	Loss rate
22:17:47.201 Nov 29	2.4	N2JTI - Harriman New York USA -- 313607	N2OKB - Francisco - Monroe New York USA -- 3136168	North America	0.000	DMR-MARC	0.0%

start time	duration	source peer alias	source radio alias	Bridge Group	RSSI (dBm)	Site name	Loss rate
22:09:21.056 Nov 29	0.5	WA2VNV - Selden New York USA -- 313612	K2HPS - Henry - Yorktown Hts New York USA -- 3136296	Worldwide	-127.9	DMR-MARC	10.0%
22:09:05.509 Nov 29	0.1	AE5DN - Stillwater Oklahoma USA -- 314007	KC5DPV - Joe - Stillwater Oklahoma USA -- 3140048	Worldwide	-108.3	DMR-MARC	0.0%
22:08:38.519 Nov 29	0.5	WA2VNV - Selden New York USA -- 313612	K2HPS - Henry - Yorktown Hts New York USA -- 3136296	Worldwide	-126.9	DMR-MARC	0.0%
22:02:35.716 Nov 29	1.3	ZL2DMR - Wellington North Island NZL -- 530200	ZL2BEZ - Paul - Wellington North Island NZL -- 5301034	WW English	-103.2	ZL-TRBO	0.0%
21:58:16.605 Nov 29	3.7	WB3EHB - Deptford New Jersey USA -- 313403	WB3EHB - Clint - Vineland New Jersey USA -- 3134027	North America	-60.1	DMR-MARC	0.0%

- 'source radio alias' is the ID and name of the user, if known.
- 'source peer alias' is the repeater they are coming in on.
- 'RSSI' is the received signal strength at the repeater, the less negative the number, the stronger you are. Levels -90 to -120 dBm are fairly weak, -80 to -60s getting stronger, above -60dBm is fairly strong.
- 'loss rate' is the packet loss rate, ie packets which contained uncorrectable errors and hence are likely to carry distorted audio. At signal levels -95dBm or better, the loss rate should be zero. High loss rates at reasonable RSSI levels are a sign of either interference on the repeater input or internet issues.

http://dmr.darc.de/ German 'last heard' site, more colourful than the cBridge site

http://www.dmr-marc.net/ Motorola Amateur Radio Club web site, many useful links

https://groups.yahoo.com/neo/groups/csidmr/info Yahoo forum for CS-700 series radios

Finally for more information this handy guide to amateur radio use of DMR is available free to download in PDF form:

http://www.dmr-marc.net/Amateur_%20Radio_Guide%20to_DMR.pdf