

Programming Your Radio: Repeaters

An overview of common steps to programming repeaters into your radio

Revision 10-April-2018

Introduction

- Programming an amateur transceiver can be difficult
- Entering repeater settings is not intuitive
- Amateur instruction manuals are easy not all time ever 😊
- The Oregon ACES Basic class reveals some programming secrets
- This presentation uses Yaesu and Kenwood rigs as a basis
- Other make & model radios might have different keys
- The same basic programming procedure still applies 95% of the time

Program a Repeater

There are five basic steps to programming a repeater channel:

1. Set Output Frequency
2. Set Shift
3. Set Tone Mode
4. Set Frequency or Code
5. Save the settings to a Memory Channel

Always test your settings by giving your call sign when channel is clear.

VFO Mode

- VFO = Variable Frequency Oscillator
- Press [VFO] button (or [V/M]; [V/MHz]; [VFO/MR]...)
 - An on-screen icon or character(s) might indicate VFO mode
- Use VFO Mode to dial-in a frequency
 - With a keypad, a frequency can be set directly while in VFO mode
 - When the VFO Knob is turned, the frequency on the display changes
 - Dial increments in FM are usually 20 kHz steps
 - Menu might allow 5, 10, or 15kHz
- Make other settings prior to saving them into a memory channel

Memory Recall (MR) Mode

- MR = Memory Recall Mode
 - Saved “channels” appear here, and VFO tuning is usually not allowed *
 - Enter MR Mode by pressing [MR] key ([V/M], [VFO/MR] key on some radios)
 - Channels or Slots are used to store new or overwrite specific frequency settings
 - For repeaters: Output frequency, offset, tone mode, and frequency / code
 - Sometimes Power level, Label/Name, or other settings can be included too
- Enter MR Mode and view which channel #'s are full and empty first
- Examples of how to Store into a Channel:
 - Press [F], turn dial to choose a channel, then [MR]
 - Tap [F], dial or up/down arrow a channel, then [M.IN] button
 - Press and hold [MW] for 1 second
 - Press and hold [F/W] for 1 second, select a channel, then tap [F/W]

Repeater Shift / Repeater DUP

- SHIFT is the difference between repeater INPUT and OUTPUT frequencies
- In Western Washington:
 - 70cm: 5 MHz
 - 1.25m: 1.6 MHz
 - 2m: 600 kHz (few exceptions)
 - 6m: 1.7 MHz (few exceptions)
- Set the Repeater Shift as 'plus' or 'minus'
 - Simplex: DUP/SHIFT is nothing (un-set)
- ARS: Automatic Repeater Shift
 - Transceiver programmed to use preset offset settings
 - Most newer transceivers use ARS properly (but not guaranteed - check it)

Tones and Codes

- Tone Modes: CTCSS and DCSS
 - Set which one to use prior to setting tone frequency or code
- CTCSS is Continuous Tone Coded Signaling System
 - Encode: Sub audible tone mixed onto the TRANSMITTED carrier
 - Decode: Correct sub audible tone must be on carrier for RECEIVER to open squelch
- DCSS is Digital Code Signaling System
 - Encode: Sub audible digital code stream mixed onto the TRANSMITTED carrier
 - Decode: Correct code stream must be on carrier for RECEIVER to open squelch

To set Tone on a repeater

1. Select TONE MODE:

- CTCSS Encode
- CTCSS Enc/Decode
- DCSS
- Often times “Tone” button or menu item

2. Select the TONE Frequency

- Also for DCSS Code Number
- Often “T-SEL” , “Tone Select”, or “Code” button or menu item

Program A Repeater Example

1. Enter VFO Mode
2. Dial-in the repeater OUTPUT frequency
3. Enable Repeater Mode / Offset / Shift (depends on radio)
 - If using A.R.S., verify the +/- offset is correct
4. Enable Tone Mode
 - Applies to: Tone/CTCSS Encode, CTCSS Decode, and DCSS
5. Set Tone Frequency to specified value
6. Save into a Memory Slot a.k.a. Channel

Check Your Work

- Enter MR mode and then turn dial to change channels
 - Screen should now show the Channel # currently selected
- Find the channel or slot number you just stored
 - Arrows, dial, or number pad the Channel # directly
- Screen should show:
 - The output frequency of the repeater
 - Plus or Minus symbol indicating the offset
 - A Tone or Code indicator on-screen, for example:
 - T, Tone, CT, CTCSS
 - DC, DCS, DTCS, etc for DCSS Code

Check Your Work

Try it:

- Volume up, squelch down, and listen for a break in traffic
- Press the PTT briefly and the INPUT frequency should display
- Say your FCC callsign and unkey
- Get (and give) a signal report from a responding ham 😊

Let's Try Programming a Repeater

- The Mountlake Terrace Repeater
- Output frequency is 443.7250 MHz
- The INPUT frequency is offset PLUS 5 MHz: 448.7250 MHz
- A Tone is required to 'open' the repeater
 - Your signal will NOT be repeated unless using the correct tone!
 - Some repeaters do not require any tone
 - Some repeaters require CTCSS tone or DCSS code
 - This repeater requires a 103.5 Hz sub-audible tone

Practice – Program These Into Your Radios

- See the ICS205 form (provided during in-person presentation)
- Use only LOW POWER for this exercise
- Check-in with NCS to verify settings (or discover issues)
- Can you tell which Repeater Shift DIRECTION each channel is by looking at the ICS 205 form?
- Watch for TX Tone/NAC vs. RX Tone/NAC!
- Be aware of differing FCC rules on using Amateur vs. FRS/GMRS vs. commercial vs. Marine vs. Air (etc)

Questions

- Why not just use a software program and a cable?
 - What if the frequency plan changes and I don't have cables/PC with me?
 - What if the cable, laptop/pc fails while I'm in the field?
- My H/T (or mobile or base) doesn't use MR Mode or VFO Mode terminology, so what are you talking about?
 - Memory Recall Mode and VFO Mode are basic ham lingo
 - Manufacturers adopt their own terminology specific to their own model lines
- Why not just rely on A.R.S. to set the shift for me?
 - Because manufacturers are national companies yet ham band plans are locally defined, so a "plus" might be a "minus" offset in your area, or an offset amount/frequency might be more/less than in another region

Questions

- These steps didn't work on my radio? Why not?
 - Again, these will work on 95% (or more) radios on the market today
 - These steps purposefully avoid naming every possible make/model keys and menu items – that's just too much information
 - Refer to your transceiver's manual and compare to these steps
- You introduced DCSS but didn't really cover it. What gives?
 - Digitally Coded Squelch System is less commonly found in this area
 - The steps to set DCSS in your transceiver are nearly identical to CTCSS/Tone
 - DCS uses Code Numbers rather than Tones, so be sure to find out what the correct DCSS Code is and use the Code menu (not Tone) to set it

The Dreaded UV-5R

How to manually program a repeater channel

Step 1. Press [VFO/MR] and enter Frequency Mode.

Step 2. Press [A/B] and choose the A Side (upper display).

Like the simplex channels, the A side must be used to program the repeater channels into the radio. Programming data entered on the B Side (lower display) will not be saved.

Step 3. Press [BAND] for the frequency band

Toggle [BAND] to choose 136 MHz (VHF) or 470 MHz (UHF).

If the incorrect band is chosen for the frequency entered in Step 6, the radio will cancel the operation.

Step 4. optional - Clear any CTCSS/DCS codes previously assigned to the channel.

If no previous codes exist or when setting up the channel for the first time and no codes are needed, set the menu items listed below to OFF.

RX DCS - [MENU] 10 [MENU] [enter 0 (OFF)] [MENU] [EXIT]

RX CTCSS - [MENU] 11 [MENU] [enter 0 (OFF)] [MENU] [EXIT]

TX DCS - [MENU] 12 [MENU] [enter 0 (OFF)] [MENU] [EXIT]

TX CTCSS - [MENU] 13 [MENU] [enter 0 (OFF)] [MENU] [EXIT]

Step 5. Disable TDR (DualWatch/Dual Standby).

Press [MENU] 7 [MENU] [press up/down arrow keys] OFF [MENU] [EXIT]

It is highly advised to turn TDR off when programming directly from the radio.

Step 6. optional - Delete any existing data on the channel to program.

Skip this step when setting up the channel for the first time. Press [MENU] 28 [press up/down arrow keys to choose channel number] [MENU] [EXIT]

It is highly advised to turn TDR off when programming directly from the radio.

Step 7. Enter the frequency.

Use the keypad to enter the frequency into the radio.

Step 8. Input the repeater frequency offset.

Press [MENU] 26 [MENU] [enter the offset for 2 meter or 70 cm repeater] [MENU] [EXIT]

Step 9. Enter the Transmit Frequency Shift.

Press [MENU] 25 [MENU] [enter 1 for positive shift or 2 for negative shift] [MENU] [EXIT]

The Dreaded UV-5R Continued

To be fair, there are a BUNCH of important steps in there you need to understand that are not DIRECTLY related to programming a repeater channel.

Repeater settings (in order) extracted from that huge list

1. Enter "Frequency Mode" [VFO/MR]
 2. Enter the output frequency
 3. Input frequency offset
 4. Enter transmit frequency shift
 5. Enter transmit CTCSS (or DCSS) code
 6. Enter repeater output frequency
 7. Assign receive frequency to a channel (new channel)
 8. Assign the transmit frequency to the same channel as step #7
- (Do you see a familiar pattern?)

The Dreaded UV-5R Continued

- Here's where I got that cheat-sheet from:

<https://w7apk.com/baofeng>

- Good to review if you have one of these radios, given all of the “extra steps” that it includes.

Kenwood TH-F6a Cheat Sheet

1. Select VFO Mode
2. Enter Output Frequency
3. Enter Repeater Offset (direction: +/-/none)
4. Activate Tone or CTCSS (Code)
5. Select Tone Frequency (Code Number)
6. Store in MEM channel
7. Select Memory Mode

Test and smile!

Icom ID-31a

From the manual:

1. Press V/MHz to enter VFO mode
2. Set the receive frequency (also set Mode: FM or DV)
3. Set the shift direction (Quick Menu -> DUP- or DUP+)
4. Activate the sub-audible Encoder (Quick Menu -> TONE or TSQL)
5. Set sub-audible tone (Quick Menu -> DUP/TONE -> Repeater Tone)
6. Hold [S.MW] for 1 second to enter Memory Write mode
7. Use Dial to select a channel # then hold [S.MW] for 1 sec to write

Kenwood TM-V71a

1. Press [VFO] to enter VFO mode
 2. Enter frequency (use mic or [F] -> [BAND SEL] then [DIAL])
 3. Set duplex [F] -> [Rev] (+, -, or (nothing))
 4. Enter Tone Mode: [Tone] (cycles through: none, T, CT, DCS)
 5. Set Tone: [F] -> [Tone] -> [Dial] in freq/code -> [Tone]
 6. Save: [F] -> [TUNING] (select a blank channel #) -> [MR]
- ...Five (okay Six) Steps to Programming Success!

Commercial Radios ;-)

1. Acquire a programming cable
2. Install and configure programming software
3. Go!

Same rules apply!

- Must set output frequency (or DUPLEX) to set a SHIFT (w/ + or -)
- Cannot set a TONE if no TONE MODE is enabled
- Must set proper Tone Type for the Tone Mode enabled (CTCSS or DCS)

Thank You For Your Attention And Participation!

Concept: Scott Honaker and Oregon ACES

Research and Slide Deck Development: Jon Rumsey

Learn more! Sign-up for an ACES class: <http://www.oregonaces.org/>

See your transceiver's instruction manual for detailed steps.