

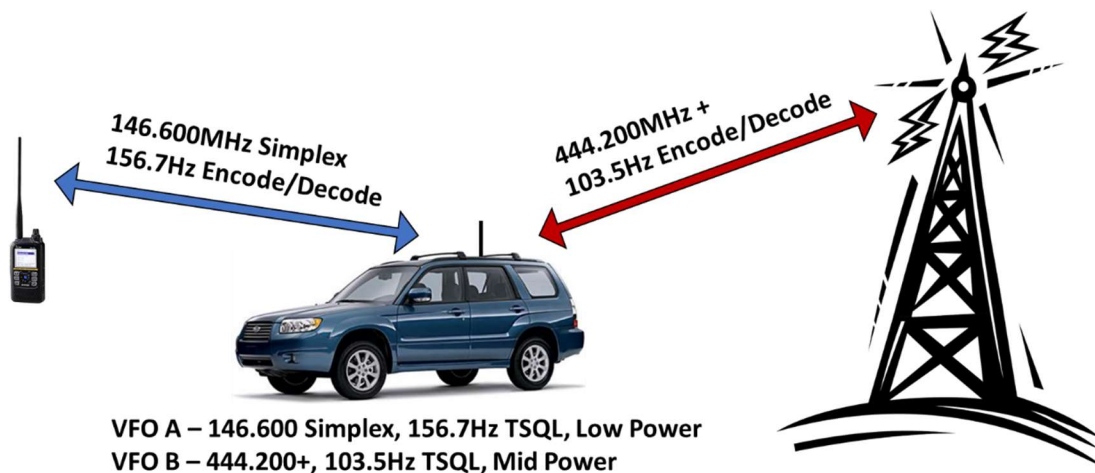
Crossband Repeater Considerations and Instructions



Crossband repeat is an incredibly valuable tool in a variety of situations. It is most commonly used to extend the range of a handheld radio with a vehicle or base station that supports crossband repeat. There are consequences to the use and misuse of this feature. It's worth looking at these issues well in advance of using it. This document will cover the theory of use, best practices and instructions for activating and deactivating crossband repeat.

Theory of Use

The basic requirement is a dual-band radio with two VFOs that can each be configured for each side of the link. Not all radios that meet these criteria can support crossband repeat. There is a selection of



supported radios at the end of this document. The diagram below illustrates the use.

In this example, the handheld communicates with the mobile radio on VFO A (left side) via VHF. The mobile communicates with the repeater on VFO B (right side) via UHF. The mobile radio must be able to communicate with the repeater on 444.200 via VFO B and with the HT on 146.000 via VFO A before enabling the crossband feature of the radio. The crossband link will fail if VFO A and VFO B can't reach their desired destinations normally. It is often desirable to have these frequencies programmed into memory in advance. They should include tone encode and decode and you'll want to verify the appropriate power levels.

Best Practices

There are some best practices to observe when using crossband repeat.

1. Both sides should use tone/DCS encode and decode to eliminate possible interference or accidental repeating of noise or unintended users.
2. Both links should be tested individually before enabling the crossband repeat feature of the radio.



3. When crossband repeating to a repeater, it is a common courtesy to inform the repeater owner so they have the ability to contact you or take action if there is an issue.
4. A control operator should be monitoring at all times. Some radios offer remote control functions but there needs to be a way to tear down the link if it misbehaves.
5. The FCC rules (part 97.119) require you ID both sides of the link. A one-way (Locked Band) link simplifies this a bit. This could be as simple as saying, "N7xxx on the N7xxx remote" if the radio doesn't offer an ID feature.
6. Be aware the radio will be operating at double its normal duty cycle so use the minimum power necessary on each link. The crossband repeater will be transmitting when either side of the link is transmitting. In the example above, there is likely to be quite a bit of traffic on the repeater. This means the mobile will be transmitting often on VHF to the HT. Keeping this link at the lowest usable power level is critical to manage heat in the radio and reduce power draw on the vehicle battery.
7. Check the local band plan to insure you are operating in a compatible way. There are designated crossband frequencies in the Western Washington band plan at <http://www.WWARA.org>.
8. Don't wait to try it until you need it. Most radios have some idiosyncrasy that makes it worth testing before you need it i.e. VHF and UHF must use specific VFOs, doesn't support memory channels, requires precise timing on button presses, certain features need to be disabled, etc.
9. Do NOT use it to connect two existing repeaters because it generally causes "ping ponging" as each repeater squelch tail activates the crossband repeater.
10. There is no need to coordinate these systems because they are generally temporary or connect to existing (coordinated) infrastructure. WWARA only coordinates systems that use a standard repeater pair.
11. When linking to a repeater, it won't be possible to respond to a transmission until the repeater tail drops because the crossband repeater will still be seeing a signal on its side of the link. It will only be able to repeat the other direction after the initial signal drops.
12. The use of tone encode and decode does impose some additional delay, particularly when transmitting to a repeater on the other end. It requires users wait a little longer before speaking and it could cause odd-sounding delays.

Radio Specific Instructions

Alinco DR-635T

This mode allows the DR-635T to operate like a repeater using both VHF and UHF bands. That is, when receiving a signal on one band, the DR635T automatically transmits the same signal on another band simultaneously.

Notes:

- The MAIN band setting cannot be altered in XBR mode.
- Any combination of VFO, memory, or CALL channels can be set as receiving and transmitting frequencies of the XBR as far as they are V/UHF combination within the transmitter's coverage.
- The XBR doesn't support digital modes such as packet and digital-voice.
- The Tone-Squelch feature supports the XBR mode to filter unwanted signals, however, the DCS feature doesn't.
- The XBR respects the offset direction and range settings of the transceiver mode.
- The TOT function is usable but TOT penalty-time and BCLO functions become deactivated during the XBR operation.

Accessing or exiting the XBR Mode

Turn the power on while holding the BAND key pressed.

★ and R icons appear on the screen. Repeat the same sequence to exit from the XBR mode.

Alinco DR-735T

- Set the bands to 145MHz and 440MHz, and select both frequencies within the transmitting range.
- Any combination of VFO, memory channels, or CALL channels can be set as receiving and transmitting frequencies provided they are 145/440MHz ham band combination.
- The XBR doesn't support digital modes such as packet and digital-voice.
- The XBR respects the offset shift, direction and selective calling tone settings.
- The TOT function is usable but TOT penalty-time and BCLO functions become deactivated during the XBR operation.
- When the DC current is cut, and comes back again, the radio turns on in XBR mode without power key operation.

To activate the XBR, turn off then press and hold the MW key while turning on the power.

XBR icons appear on the display. Repeat the same to exit from the XBR mode.

Anytone AT-5888UV

Set the left band and right band as VHF (136-174 MHz) and UHF (400-470 MHz), then turn on this function to enable Cross Band Repeat. CAUTION: DO NOT EXCEED MID2 (10 WATT) POWER LEVEL, AS THIS WILL VOID YOUR WARRANTY.

1. Press [SET] key to enter function menu.
2. Switch the selector knob to choose No. 44 function. The LCD displays "X-RPT".
3. Press the main band selector knob. The LCD displays "XSTART".
4. Press the main band selector knob, the radio beeps and the LCD displays "RPT". The cross band repeat function is on. Press [SET] to turn off cross band function.



Anytone AT-D578UV

Menu (56) Repeater (Cross-band)

Turning on the cross-band repeater function will allow the radio to work as a small local repeater. The radio will TX on one channel, RX on the other channel.

- Note:** Cross-band Analog-Analog: Must be UHF-VHF, or VHF-UHF cross bands.
Cross-band Analog- Digital: Must be UHF-VHF, or VHF-UHF cross bands.
Cross-band Digital- Digital: UHF-VHF, or VHF-UHF cross bands, different time slot.
Cross-band Digital- Digital: Same UHF or same VHF bands, different times lot.
Cross-band Same frequency Digital-Digital: TX and RX are at same frequencies, but different time slots on VFO A and VFO B. Radio must also be in Double Slot operation.

** Please Turn Off Digital Monitor when using the Cross-band repeat function**

Analog (A) to Analog (A) Cross band Repeater Setup

- a. To set the channels or frequencies you will want to use with cross band operation, the radio must be set to display both the Main Channel (VFO A) and the Sub-Channel (VFO B).
- b. Set the analog channel with simplex or repeater frequency.
- c. Turning the Repeater function ON in the Radio Settings menu.

Analog (A) to Digital (D) or Digital (D) to Analog (A) Cross band Repeater Setup

- a. To set the channels or frequencies you will want to use with cross band operation, the radio must be set to display both the Main Channel (VFO A) and the Sub-Channel (VFO B).

b. Set the analog channel with simplex or repeater frequency, and set the digital channel with simplex frequency only.

c. Turning the Repeater function ON in the Radio Settings menu.

Digital (D) to Digital (D) Cross band Repeater Setup

a. To set the channels or frequencies you will want to use with (D) to (D) cross band operation, the radio must be set to display both the Main Channel (VFO A) and the Sub-Channel (VFO B).

b. Enter the Simplex channel or Simplex frequency for VFO A and the Simplex channel or frequency for (VFO B).

c. Set the correct Color Code and set the two (VFO) channels to DIFFERENT Time Slots (TS) d. Set the radio to Double Slot operation. e. Turning the Repeater function ON in the Radio Settings menu.

**Allows the VFO A and VFO B at same frequency but different time slot, the radio will work as a digital single frequency repeater.

Icom Crossband Control Codes

DTMF Control Codes*

Remote on	B,000, #	The 000 may be your own 3 digit DTMF security code
Remote off	B*	
Crossband on	DB*	Direct keyboard entry of frequency or memory channel
Crossband off	DB, 000, #	
Call	1	
Memory	2	
VFO	3	
High Power	6	
Low Power	9	
Voice	DC	
Enter	D	
Up	#	
Down	*	
Clear	A	

*Note: Not all Icom mobiles have remote capability. Please check your owner's manual for more details.

Icom IC-2720

To Use Cross Band Repeat Mode:

- Set the frequencies on both bands (Receive on VHF on left e.g. 146.550, Send UHF on right e.g. 444.525)
- Press and hold LOW and DUP on the faceplate, then quickly press SET (above the right-side volume knob) for two seconds, then let go of all 3 buttons
- Two flashing Ls will appear on the display -- (the Ls must be flashing)

To exit this function: press SET for two seconds

Icom IC-2730

To Activate Cross-Band Mode

Before you activate cross-band, set the frequencies you will need. Frequencies can be set in VFO or using Memory Channels, or also using VFO and a Memory Channel.

Note: Once this procedure has been completed, the cross-band feature will now appear in the menu unless a full reset is performed.

1. Press and hold both MAIN keys, MONI, and then press power.
2. Press MENU.
3. Rotate a tuning knob and select EXMENU.
4. Press MW. Rotate a tuning knob and select OTHERS.
5. Press MW. Rotate a tuning knob and select RPT M.
6. Press MW. Rotate a tuning knob and select START.
7. Press MW. Rotate a tuning knob and select YES.
8. Press MW. The display will show both bands with rPt listed under the frequencies. The cross-band feature is now activated and you may operate in cross-band mode.

To Exit Cross-Band Repeat Mode

1. Press Menu.
2. Rotate a tuning knob and select YES.
3. Press MW. To return to cross-band repeat mode, perform steps 2- 8 as above.

Icom IC-2800

1. Prior to the cross band mode, set the squelch delay to short or the audio for the first 3 seconds will be chopped off in your next transmission. (Use the set-up menu shown in the manual).
2. To start the cross band mode, set the VHF and UHF frequencies you like to link together for cross band operation, (program the splits, PL tone, etc. all in advance)
3. Main Step-Press and hold "CHG/L" button while holding both VHF and UHF "MAIN" buttons simultaneously for few seconds until the blinking key icon appears.
4. Optional-Set hang up time to ZERO on cross band repeat mode by pressing and holding "CHG/L" button while holding UHF "MAIN" and bottom menu key at VHF side for few seconds. The Key lock indicator will blink, and the unit is ready to operate. (This is a direct translation from the Japanese manual. You may omit this step or experiment with it.)

To disable the cross band, repeat the step #3 above until the blinking KEY icon disappears.

Icom IC-2820

ACTIVATE CROSSBAND REPEATER:

1. Select a (2M) frequency on the left side (VFO or memory channel)
2. Select a (70cm) frequency on the right side (VFO or memory channel)
3. Push AND Hold Both RIGHT and LEFT Band Knobs until you hear a BEEP
4. WHILE STILL HOLDING KNOBS, Press the "F" button (between the right vol/sql knob and band knob) until it BEEPS and you see the "Key" Icon Flash on the upper right side of the display
5. Crossband is ready to use. You cannot change settings freq. until deactivated.

TO DEACTIVATE:

- Press "F" until you hear beep and/or key icon disappears.

Icom ID-5100A

1. Select VHF and UHF frequencies
2. Touch [MENU]
3. Touch "Repeater Mode." (Others > Repeater Mode)
 - If the item is not displayed, touch [^] or [v] one or more times to select another page.

4. Touch “<<Repeater Mode>>.”
 - “Enter the Repeater Mode?” appears.
5. Touch [YES].
 - Enters the Repeater mode.
 - In the Repeater mode, [RPT] blinks instead of the function group icon

NOTE: You cannot enter the Repeater mode when:

- The AM, AM-N or DV mode is set.
- Single band operation is set
- The frequency is out of the Ham band

“BUSY” appears and the S-meter displays the relative signal strength level on the receiving band display. The S/RF meter displays the output power level, and “TX” blinks on the transmitting band display.

Transmission is automatically cancelled according to the “Hang Up Time” item setting. When the “Hang Up Time” item is set to OFF, the transceiver cancels the transmission when the receive signal disappears. When the “Hang Up Time” item is set to ON, the transceiver cancels the transmission approximately 0.25 seconds after the receive signal disappears. You can set the “Hang Up Time” item in the Menu screen.

Exiting the Repeater mode

1. Touch [RPT]
 - “Exit Repeater Mode?” appears
2. Touch [YES]

Icom IC-901

Crossband repeat - turn power on while holding down check and lock buttons. If crossband repeat has been engaged, the "lock" display will flash. PL cannot be selected in either band for crossband repeat to work. If you need PL to operate the repeater you are linked to, generate it on the radio you are using to talk to the 901. The PL will pass through the 901 just fine to access the linked system. Since the radio is in the locked mode, you can't change frequencies or bands during crossband repeat.

To disengage crossband repeat, turn off power or press lock button. If there is no audio during crossband repeat, open up the front of the dual-band unit by removing the plastic cover behind where the control head would plug in if the 901 is not used in the remote-control head configuration and look for a slide switch mounted on the edge of one of the vertical circuit boards and slide it the other way. The switch does not seem to come in any pre-determined configuration from ICOM, so some radios work OK for crossband repeat right out of the box, and some require the switch to be in the opposite position.

Icom IC-910

To enable crossband repeater install HD4.

To use crossband repeater:

- Activate [LOCK]
- Switch off the radio
- Push and hold M/S while switch on the radio

To exit push [LOCK](Crossband repeat will not be canceled if power is switched off.)

Icom IC-9100

To enable this feature, add D1529 to the MAIN board (PN 1750002020).

Verify the Following Settings

1. Turn the power ON.
2. Verify the following:
 - a. Satellite mode: OFF
 - b. Mode: FM (both MAIN and SUB bands)
 - c. BLANK indication: Disappear (both MAIN and SUB bands)
3. Set frequencies, Repeater Tones, and Offsets for Main and SUB bands.
4. Set Dial Lock function to ON.
5. Turn the power OFF.

Enter the Repeater Mode

Turn the power ON while pushing [MAIN /SUB] button.

Exit from Repeater Mode

Set the Dial Lock function to OFF.

Kenwood TM-D700

1. Turn radio ON
2. Ensure TNC is turned OFF [Depress and Hold Function button until "TNC" appears, then depress "TNC". Repeat until "TNC APRS" and "TNC PKT" are replaced with a BLANK display.
3. Tune Band A (Left) to 2m Simplex or Repeater frequency (VFO or Memory Channel)
4. Conduct radio check on Band A.
Tune Band B (Right) to 70cm Simplex or Repeater frequency (VFO or Memory Channel)
5. Conduct radio check on Band B.
6. Depress Menu Button (Bottom, Right Side)
7. Rotate Tuning Knob (Bottom Left) to "RADIO" [1-]
8. Press "OK" button
9. Rotate Tuning Knob to "Repeater" [1-7]
10. Press "OK" button
11. Rotate Tuning Knob to "6" [1-7-6] [current selection will start to flash in bottom right corner of display]
12. Rotate Tuning Knob to "CROSS-BAND" [the display will flash "OFF", "Locked-Band", or "CrossBand"]
13. Press "OK" button [Display will STOP flashing].

Note: This transceiver has an automatic 3-minute Time Out Timer.

To Exit Cross-Band Repeat:

1. Press Menu
2. Access 1-7-6
3. Press "OK"; rotate tuning knob to "OFF"; press "OK"
4. Press "ESC" (left side, bottom row of keys).

Kenwood TM-D710

1. Set the left VFO something on 2m
2. Set the left VFO the PTT/Control VFO

3. Set the right VFO something on 440
4. Turn off the radio
5. Hold down the 3rd left-most button (TONE) and hold down the Power button (top right most button)

To disable the crossband repeat mode, turn off the radio then hold down the 3rd left-most button (TONE) and hold down the Power button (top right most button)

Kenwood TM-V71

1. Enter Menu mode and access Menu 403 (RPT.MOD) {page 20}.
2. Set the Repeater operation mode to CROSS (cross-band), A-TX (A band), or B-TX (B band)
3. Turn the transceiver power OFF
4. Press [TONE] + Power ON.
 - The Repeater mode is ON and the [PTT] and [Lock] icons blink on the display.
 - You are unable to perform any transceiver functions while in Repeater mode.
 - To return to normal operation, turn the transceiver power OFF, then press [TONE] + Power ON.

Kenwood TS-2000

1. Select a desired receive frequency on the subreceiver.
2. Press [MAIN] and select a desired transmit frequency on the main transceiver.
3. Adjust the squelch threshold level so that both receivers mute.
4. Press [MENU], then turn the MULTI/ CH control to access Menu No. 61A.
5. Select CROSS, using [+].
 - “ ” appears.

Note:

- The Repeater function has its own Time-out Timer which is set at 3 minutes. This value cannot be changed.
- After activating the Repeater function, you cannot access Menus other than 61A and 61B.

Hang Time for Repeater Function

If necessary, you can cause this transceiver to remain in the transmit mode for 500 ms after signals drop. Access Menu No. 61B and select “ON”.

Powerwerx DB-750X

Set the left band and right band as VHF (136-174 MHz) and UHF (400-470 MHz), then turn on this function to enable Cross Band Repeat. CAUTION: DO NOT EXCEED MID2 (10 WATT) POWER LEVEL, AS THIS WILL VOID YOUR WARRANTY.

5. Press [SET] key to enter function menu.
6. Switch the selector knob to choose No. 44 function. The LCD displays "X-RPT".
7. Press the main band selector knob. The LCD displays "XSTART".
8. Press the main band selector knob, the radio beeps and the LCD displays "RPT". The cross band repeat function is on. Press [SET] to turn off cross band function.



Wouxun KG-UV950P

1. When the radio is in standby, press the [MENU]+[3/DSCAN]+[2/MHZ] keys and the screen will display **RPT-SET**
2. Press the [MENU] key to select and [^] or [v] to select the directional cross-band repeater (X-DIRPT) or full two-way cross-band repeater (X-TWRPT)
3. Press the [MENU] key to confirm and set

Yaesu FT-8800

Enabling the cross band function (Pg. 56)

1. Configure the band(s) as needed with power and ENC.DEC as needed.
2. Press the **SET** key momentarily.
3. Rotate the **MAIN** band **DIAL** knob to select Menu 45 (X-RPT).
4. Press the **MAIN** band **DIAL** knob momentarily. X-START will appear.
5. Press the **MAIN** band **DIAL** knob again to activate the cross band repeater mode.
6. To exit, press the **SET** key.

Yaesu FT-8900

Enabling the cross band function (Pg. 54)

1. Configure the band(s) as needed with power and ENC.DEC as needed.
2. Press the **SET** key momentarily.
3. Rotate the **MAIN** band **DIAL** knob to select Menu 44 (X-RPT).
4. Press the **MAIN** band **DIAL** knob momentarily. X-START will appear.
5. Press the **MAIN** band **DIAL** knob again to activate the cross band repeater mode.
6. To exit, press the **SET** key.

Yaesu FTM-350

1. Turn the APRS modem off.
2. Set a UHF frequency in either the upper or lower display, using either the VFO or memory.
3. Set a VHF frequency in the other display, using either the VFO or memory.
4. Turn the FTM-350 off.
5. Turn the radio on while holding the key located left of the [POWER] switch to enter the “Special Function Menu”.
6. Rotate the **left side** [DIAL] knob to select 11 XBAND REPEATER
7. Once selected, press **left side** [DIAL] knob and confirm (OK? [SET]) is displayed on the screen.
8. Press **left side** [DIAL] knob once more to confirm the operation

Exiting Cross-band Mode

1. Turn the FTM-350 off.
2. Turn the radio on while holding the key located left of the [POWER] switch to enter the “Special Function Menu”.
3. Rotate the **left side** [DIAL] knob to select 11 XBAND REPEATER
4. Once selected, press **left side** [DIAL] knob and confirm (OK? [SET]) is displayed on the screen.
5. Press **left side** [DIAL] knob once more to confirm the operation

Yaesu FTM-400

Entering Cross-band mode

1. Turn the APRS modem off.
2. Set a UHF frequency in either the upper or lower display, using either the VFO or memory.

3. Set a VHF frequency in the other display, using either the VFO or memory.
4. Turn the FTM-400 off.
5. Press and hold the lower 3 buttons to the right of the display then press the power button. “X-BAND Repeater” will be displayed between the upper and lower frequency displays, if the FTM-400 transferred into cross-band repeater mode.

Exiting Cross-band mode

1. Turn the FTM-400 off.
2. Press and hold the lower 3 buttons to the right of the display then press the power button. “X-BAND Repeater” will not be displayed between the upper and lower frequency displays, if the FTM-400 transferred out of cross-band repeater mode.
3. Return the frequencies to your preferences.
4. Turn the APRS modem on, if you run APRS.

The Western Washington Amateur Relay Association (WWARA) is THE repeater coordination body for Western Washington State. In addition to coordinating Amateur Repeaters, the WWARA publishes band plans for Western Washington, works with neighboring Repeater Coordinating bodies to resolve interference issues, as well as repeater owners in Western Washington. WWARA publishes the authoritative coordinated repeater list nightly in multiple formats including PDF, CSV and CHIRP. Repeater coordination is offered at no charge and WWARA membership is open to ALL amateur radio operators for a modest fee. Find further whitepapers, repeater lists, band plans and become a member on the WWARA website at <https://www.wwara.org>.
