

# *Ham Tips*

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## Using a Single Cross Band Repeater as a Dual Frequency HT Range Extender

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Have you ever been in a situation where your trusty HT didn't have quite enough steam to get the job done? You know the story, you're assigned to shadow an official and he asks you to send an important message to the EOC. Eager to please, you key your HT only to find that, although you can trip the repeater, your signal isn't strong enough to hold it so you can pass the message.

Being a well prepared Ham, you immediately go to Plan B. You replace the ubiquitous rubber duck with a better antenna and try again; but, your signal is still too noisy to copy.

Undaunted, you go to Plan C. You know that raising the height of your antenna will improve your signal, so, to the amazement of the official, you stand on the roof of his car and try again. Unfortunately, your signal is still just a tad too weak to be copied reliably. Now what do you do?

Probably the next step would be to set up a cross band repeater to serve the area in which you're deployed. But what if you needed to access two different repeaters, one to pass tactical traffic and another to pass health and welfare traffic. Would you need two conventional cross band repeaters to accomplish this feat? The short answer is no, you wouldn't; you can do it using only one.

### **The Concept**

It's possible to use a single mobile radio as a cross band repeater that can be used to extend the range of an HT on two separate frequencies without operator intervention. The technique requires that both the mobile radio, which is being used as the cross band repeater, and the hand-held radio have certain specific features so they can work in concert with each other.

The mobile radio must have the capability to cross band repeat and the capability to program a non-standard repeater split, sometimes called an independent transmit frequency or odd repeater split. The hand-held radio must be a dual band unit with the capability to receive on two frequencies simultaneously, a feature sometimes called dual receive. These features are not standard on most radios; but, if your radios have them, you can use them to set up a dual frequency, one-way range extender for your low power HT.

To make this work, one channel of the mobile radio must be programmed to cross band repeat between a UHF simplex frequency and the input of one of the VHF repeaters. Then, another channel must be programmed to cross band repeat between a different UHF simplex frequency and the input of the other VHF repeater.

This method works because the mobile radio listens only on the two UHF simplex frequencies. As long as the mobile radio is not receiving a signal on one of those frequencies, it does not transmit. However, when the mobile radio receives a signal on one of the UHF frequencies, the signal will be retransmitted on the VHF frequency of the opposite channel.

You listen to the VHF repeater output frequency directly on your HT. Audio from the VHF repeater is never sent through the cross band repeater. In this particular configuration, the mobile radio never listens on the VHF frequencies; it only transmits on them. As a result, the mobile radio cannot be keyed by any signals on the input or the output frequencies of either VHF repeater.

In essence, the mobile radio operates as two independent one-way (transmit only) repeaters. Although this technique will not allow you to use both cross band repeaters simultaneously,

it will save you the trouble of returning to the mobile radio in order to reconfigure it for use on the other repeater frequency.

To avoid extraneous on-channel signals from inadvertently keying either VHF repeater, you should always use PL on the UHF simplex frequencies.

This is a nifty solution if you are in a position where you can hear the repeaters directly on your HT but can't get into them with a strong enough signal. You don't have to wait for the carrier of the VHF repeater to drop before you can transmit; you have the convenience of switching between the two VHF repeaters by simply changing channels on your HT; and, you only need one mobile radio configured as a cross band repeater to access two different VHF repeaters.

Compared with a conventional cross band repeater, this technique has one downside. The audio from the VHF repeaters is not rebroadcast on the UHF frequencies. But as long as you can hear both VHF repeaters directly on your HT, you get to access two repeaters as opposed to one. This could be a significant benefit if you ever need to use one repeater for passing regular traffic and another for emergency traffic.

Here's how you would program the memories in the mobile radio you want to use as the cross band repeater. First, you would program memory channel X to be a UHF simplex frequency and program the odd-split transmit frequency to be the input frequency of repeater B. Next, you would program memory channel Y to be another UHF simplex frequency and program the odd-split transmit frequency to be the input frequency of repeater A.

After you've programmed the mobile radio, enable the cross band repeat mode. Then simply set your HT to transmit on channel X to get into Repeater A or channel Y to get into Repeater B. The following examples along with Table 1 clarify the programming method.

**Table 1  
Mobile Radio Programming**

MODE	RADIO SIDE		REMARK
	LEFT	RIGHT	
Receive	446.200	X	Example 1
Transmit	147.62		
Receive	446.200	X	Example 2
Transmit	147.64		

**Example 1 – For Kona**

The objective is to be able to use a low power, dual band HT to pass traffic to either the Hawaii County Civil Defense Emergency Operation Center in Hilo via the BIWARN repeater located on Hualalai (147.76/147.16 MHz) or to the State Civil Defense EOC via the RACES repeater located on Haleakala (147.62/147.02 MHz). Since the HT can hear both of these repeaters fine but does not have enough power to access either one of them with a signal of acceptable quality, the strategy is to use a mobile radio as a dual frequency, one-way range extender.

To accomplish this, program a memory channel for one side of the mobile radio to receive on 446.200 MHz with a PL of 162.2 Hz and transmit on 147.62 MHz with no PL. Then, program another memory channel for the other side of the mobile radio to receive on 446.400 MHz with a PL of 162.2 Hz and transmit on 147.76 MHz with no PL.

On the HT, program a memory channel to receive and transmit on 446.200 MHz with a PL of 162.2 Hz. Then, program another memory channel to receive and transmit on 446.400 MHz with a PL of 162.2 Hz.

To use this configuration, place the mobile radio into the cross band repeat mode. To pass traffic via the BIWARN repeater, set the VHF side of the HT to receive the 147.16 MHz repeater and the UHF side to 446.200 MHz simplex. To pass traffic to the RACES repeater, set the VHF side of the HT to receive the 147.02 MHz repeater and the UHF side to 446.400 MHz simplex.

**Example 2 – For Hilo**

The objectives and strategy are the same as in the previous example. The differences are that the BIWARN repeater is located on Kulani Cone and uses 146.16/146.76 MHz whereas the RACES repeater is located on Mauna Loa and uses 147.64/147.04 MHz.

For this application, program one side of the mobile radio to receive on 446.200 MHz with a PL of 162.2 Hz and transmit on 147.64 MHz with no PL. Then, program the other side to receive on 446.400 MHz with a PL of 162.2 Hz and transmit on 146.16 MHz with no PL. Program the HT the same way as in Example 1.

To use this configuration, place the mobile radio into the cross band repeat mode. To pass traffic via the BIWARN repeater, set the VHF side of the HT to receive the 146.76 MHz repeater and the UHF side to 446.200 MHz simplex. To pass traffic via the RACES repeater, set the VHF side of the HT to receive the 147.04 MHz repeater and the UHF side to 446.400 MHz simplex.

**Summary**

This Ham Tip described a way of using a single mobile radio as a dual frequency cross band repeater to extend the range of a low power, dual-band HT. This non-conventional approach to cross band repeating lets you select one of two cross band repeaters by simply changing channels on your HT; no reconfiguration of the cross band repeater is required. And, the fact that you no longer have to wait for the VHF repeater's carrier to drop before you can begin transmitting is a very convenient bonus indeed. Thanks to Peter Abraham, KB7INO, for bringing this technique to my attention.

*73 from KH6CQ*

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