

# CROSSBAND RADIO OPERATION (analogue FM)



Janis VA7JNX

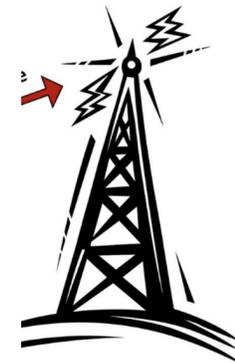
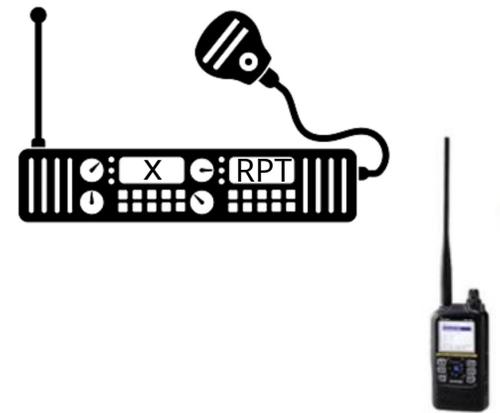
21 FEB 2026

# Crossband repeat function

Radios with cross-band repeat function can be set to **automatically** re-transmit a signal received on **one band** to the **other band**... through a single dual-band antenna.

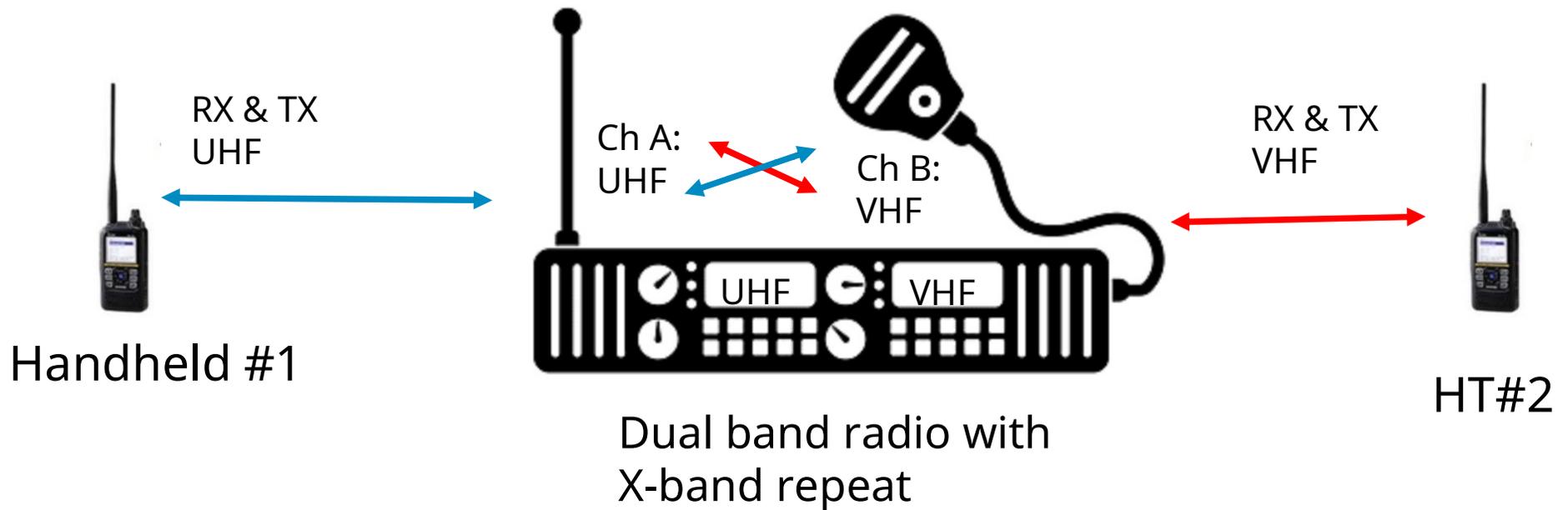
**Two** bands: because these small, cheaper systems need wide frequency separation (e.g. 144 MHz : 432 MHz)

Tower-based repeater systems can repeat on the **same** band... by using duplexers that can split inbound and outbound signals that may have minimal frequency separation (e.g. 0.6 MHz separation for 2 meter band)



# X-band radio allows it to function as a **SMALL LOCAL REPEATER**.

The signal received on one band is **CROSSED** over to the other band & transmitted



X-band... when a simplex connection will not work.

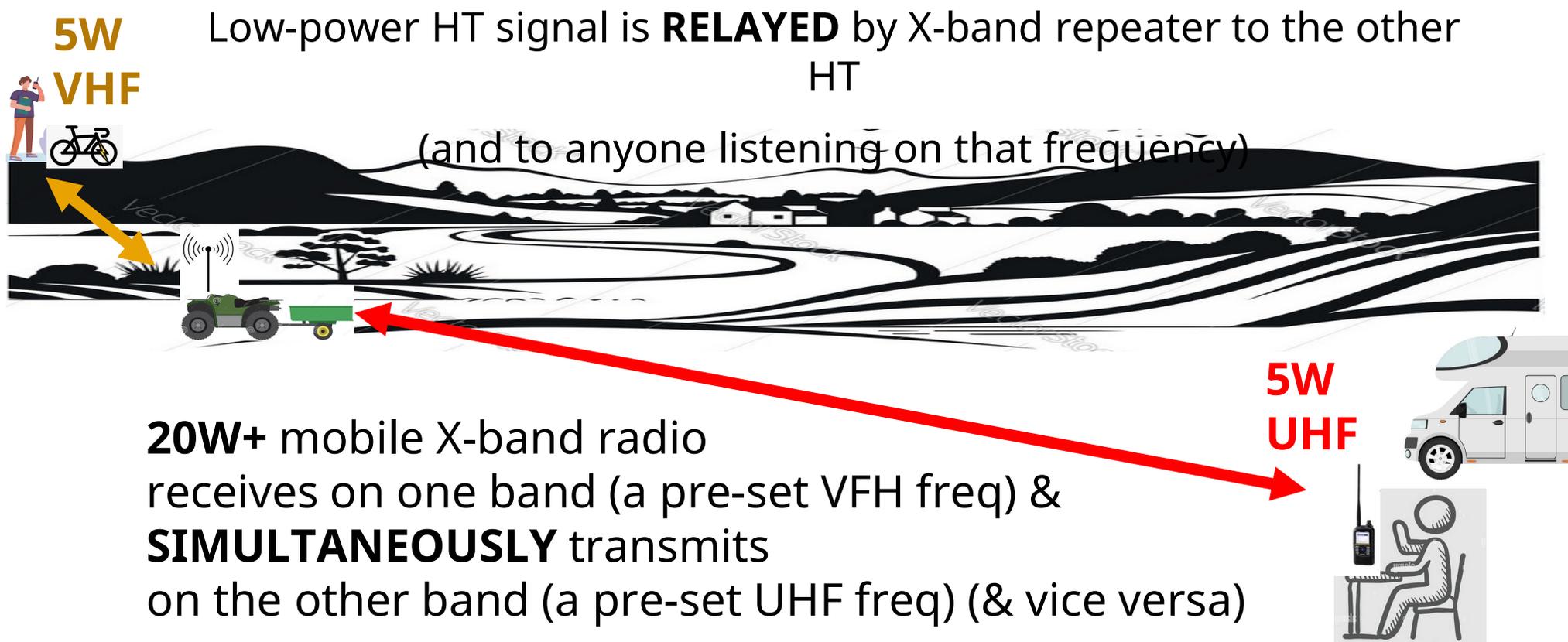
# Crossband function in a portable radio

- Crossband radio operation requires:
  - dual bands
  - dual VFOs
  - built-in crossband repeat function
  - one dual band antenna
- Good power source (in case of high duty cycle)
- Mobile/base radio or handheld, but
  - mobile/base radios can transmit with **greater power** (20W+)
  - mobile/base radios usually use a **better antenna**



# X-band radio extends range of low power radios

## Simplex example (no repeater tower used)



# Crossband Simplex

✦ X-BAND radio

HT#1

HT#2

VFO (or channel)

**RX/TX: 146.55**

**446.175**

**Channel A\*** -the UHF Band

~~**RX/TX: 446.175 MHz**~~

VFO (or channel)

**RX/TX:**

**Channel B\*** -the VHF Band

**RX/TX: 146.55 MHz**

*\* Does not matter which channel is the VHF or the UHF*

*Pre-programmed channels are easier than VFO*

# Frequencies for all radios are determined in advance

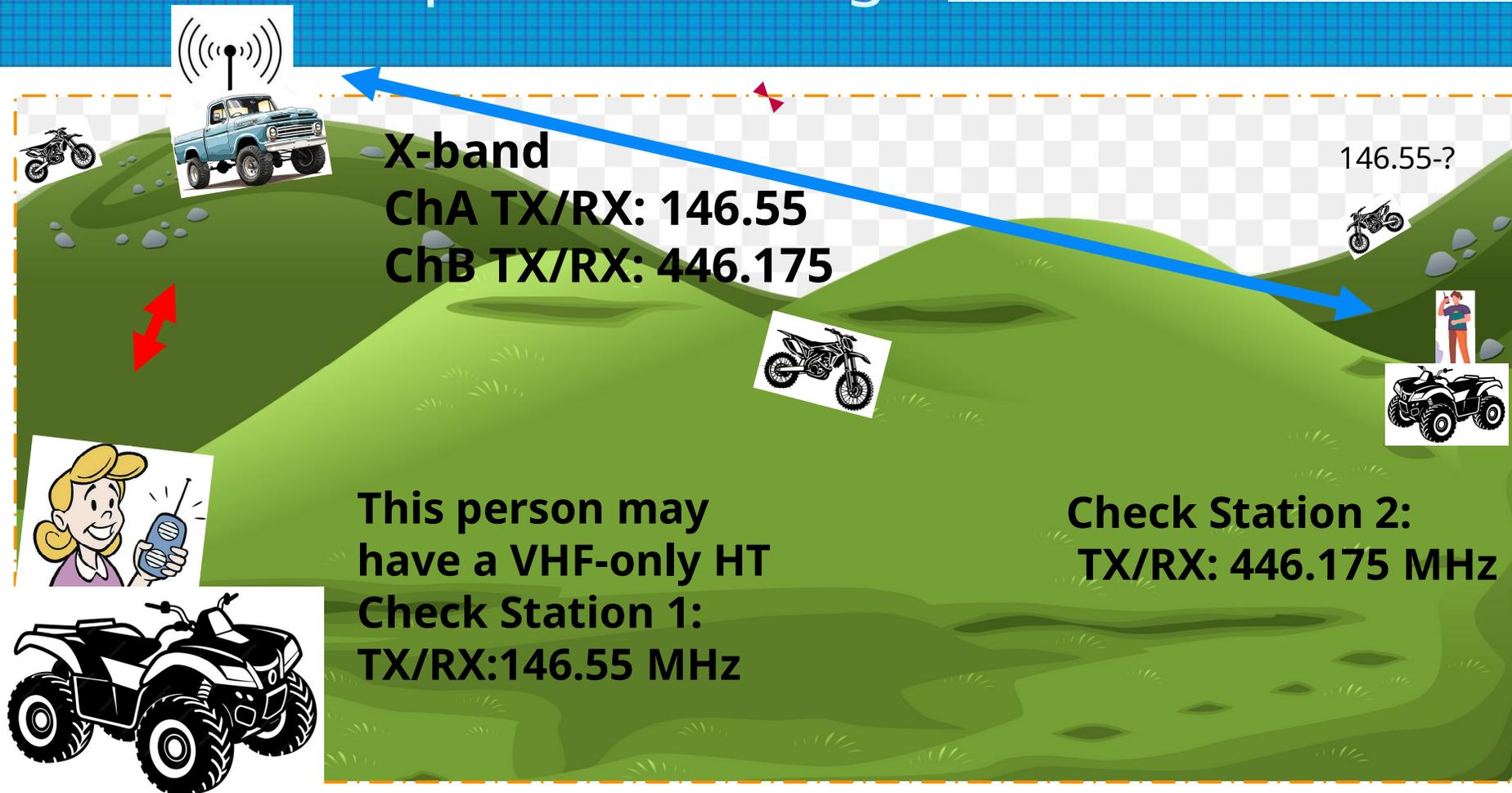
The crossband radio typically works with **2m** and **70cm repeater** bands:

- a **pre-determined** RX/TX frequency in 144 MHz band (VHF) on one channel (e.g. 144.55 MHz, simplex)
- a **pre-determined** RX/TX frequency in 432 MHz band (UHF) on the other channel (e.g. 446.175 MHz, simplex)
- [**one repeater's frequencies** may be set as the VHF **or** UHF channel, depending on the repeater's frequency pair... normal offset for TX/RX and tone apply]

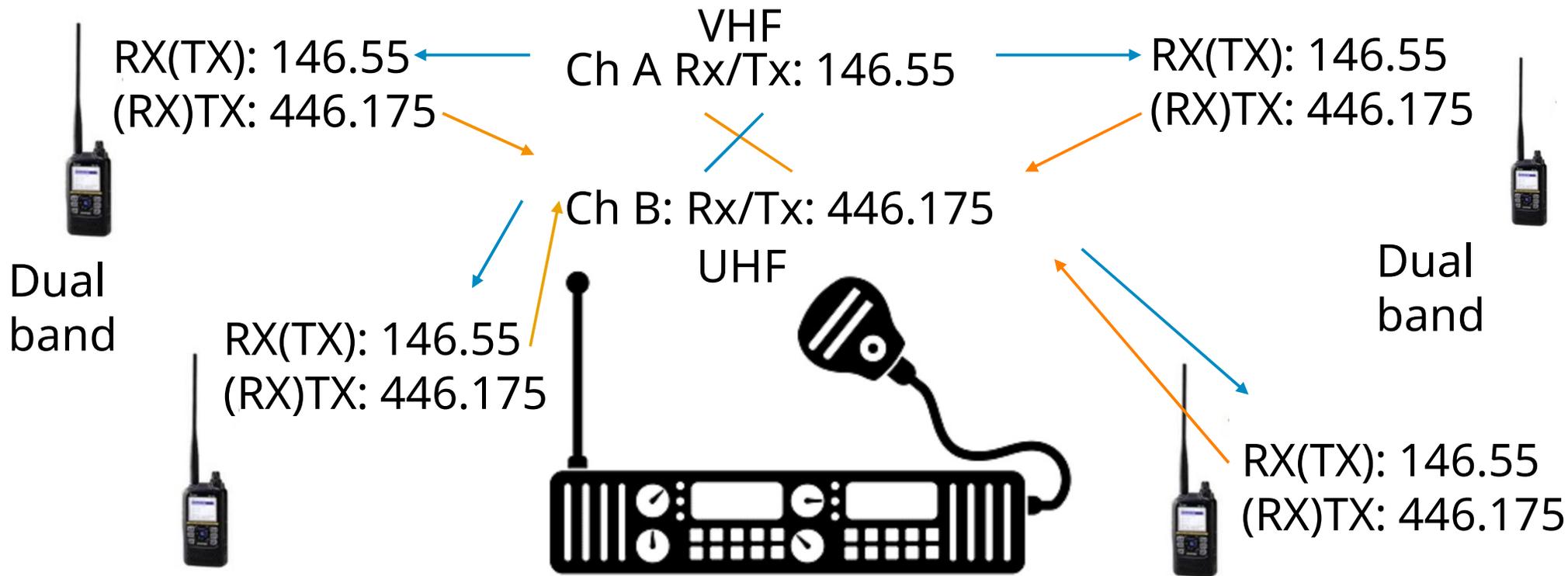
Turn on the radio's repeater function called "Xband" or "Rptr" etc.

Radio works **unattended**... mic & channel change are automatically disabled when repeat function is on

# X-band radio positioned high around landforms



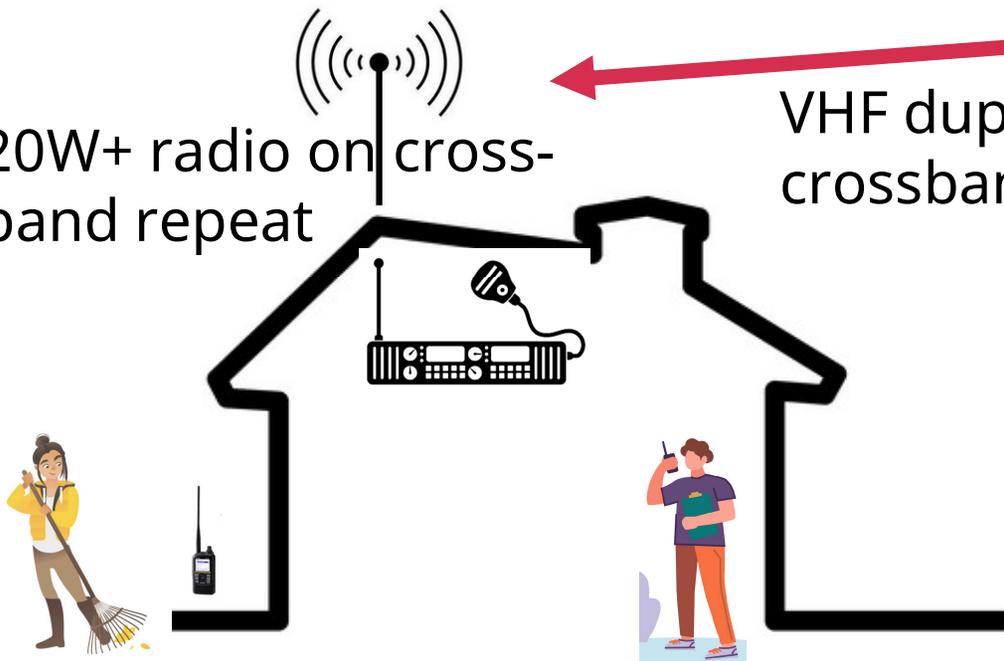
More than 2 Hts? Set-up channels with RX/TX on separate bands on multiple dual band HTs all programmed the same way



\*\*\* Radios must have dual VFOs (not dual "watch")

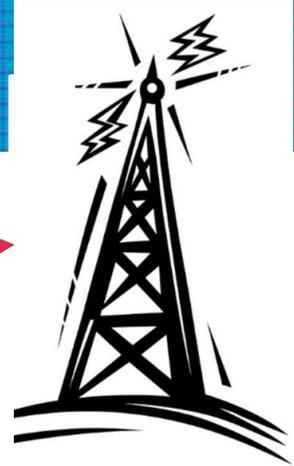
# X-band for mobility around the house in simplex & duplex to/from a repeater

20W+ radio on cross-band repeat



5W HTs: UHF simplex around the building

VHF duplex between crossband and repeater



To all those listening while 20:20 net in progress

# Crossband to repeater uses offset (aka shift) and HT is set with a tone (aka pl tone, CTCSS etc.)

**HT  
Repeater**

**Channel:**

RX/TX: 446.175 MHz

**Tone: 100 kHz)**



**X-BAND radio**

**"78"**

**Channel A (or B)**

RX: 146.78

TX: 146.18 (**T: 141.3**)

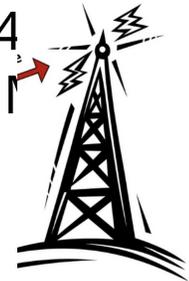
**Channel B (or A)**

RX/TX: 446.175 (**Tone: 100**)

RX: 146.18 (**T: 141.3**)

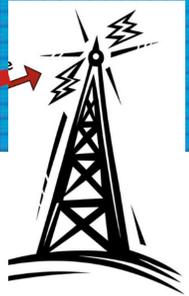
TX: 14

(Note: offset of -0.6 MHz)



Best practice: use **Channels** and set a **tone**  
for all frequencies, so less interference may be heard

X-band radio use in an emergency  
in a valley in the back country (no cell or repeater coverage)



VHF  
to/from  
"78"  
repeater



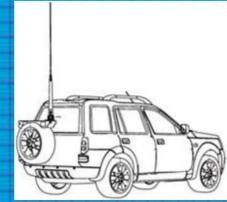
To those on  
146.78 MHz

UHF  
to/from  
X-band



\*Wait for  
repeater tails to drop

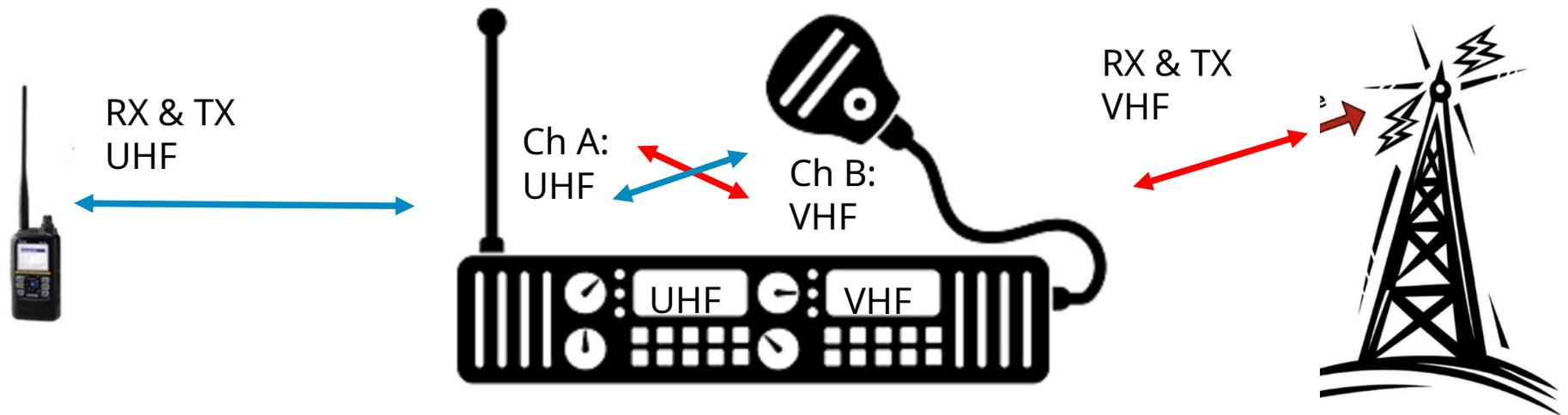
# Crossband uses



1. extends the range of a low-power HT radio... through the higher power crossband radio
  2. transmit around a landform... requires careful placement of a mobile crossband radio, often in a vehicle parked on hilltop
  3. allows for easier mobility... carry a lightweight HT & connect through a crossband radio
  4. useful in emergencies... aids communication out from outdoor areas where neither repeaters nor cell phones towers offer coverage
- (also an HT inside a building may not reach a repeater, but can reach the X-band radio in a vehicle parked outside, which will reach a repeater)

# So far...crossband radio does double duty

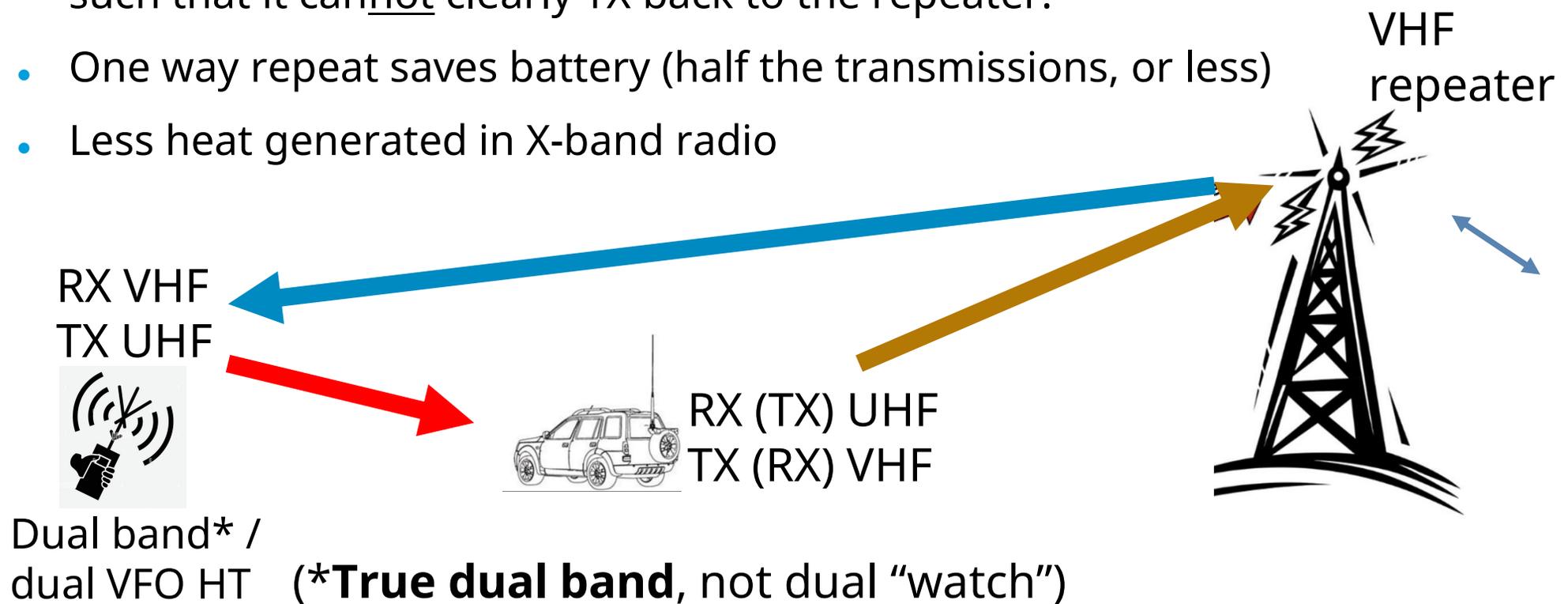
X-band transmits **BOTH** when HT transmits **AND** as the Repeater transmits the reply.



X-band battery is used up more quickly  
AND radio heats up if transmitting too much

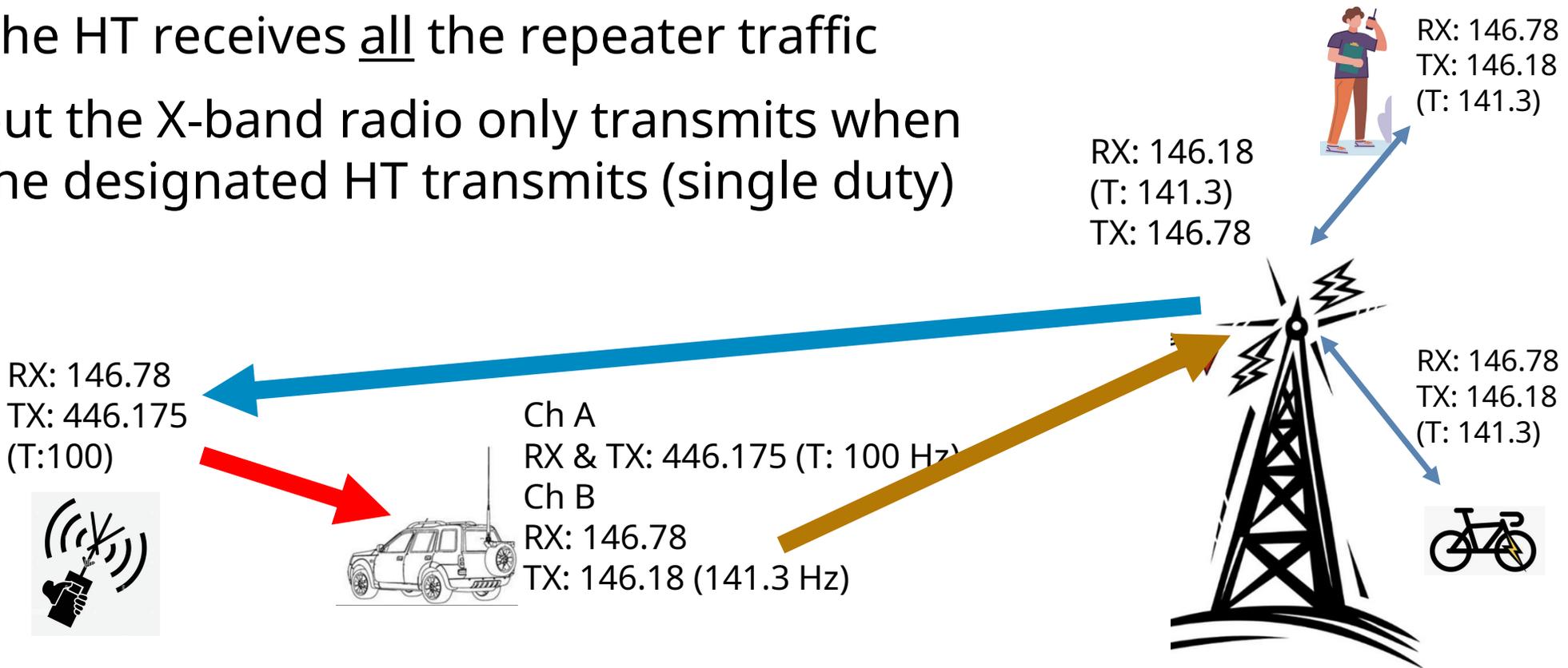
# One-way repeat (uni-directional) (Dual band required on the HT)

- In this case a handheld can RX from a repeater, but is located such that it cannot clearly TX back to the repeater.
- One way repeat saves battery (half the transmissions, or less)
- Less heat generated in X-band radio

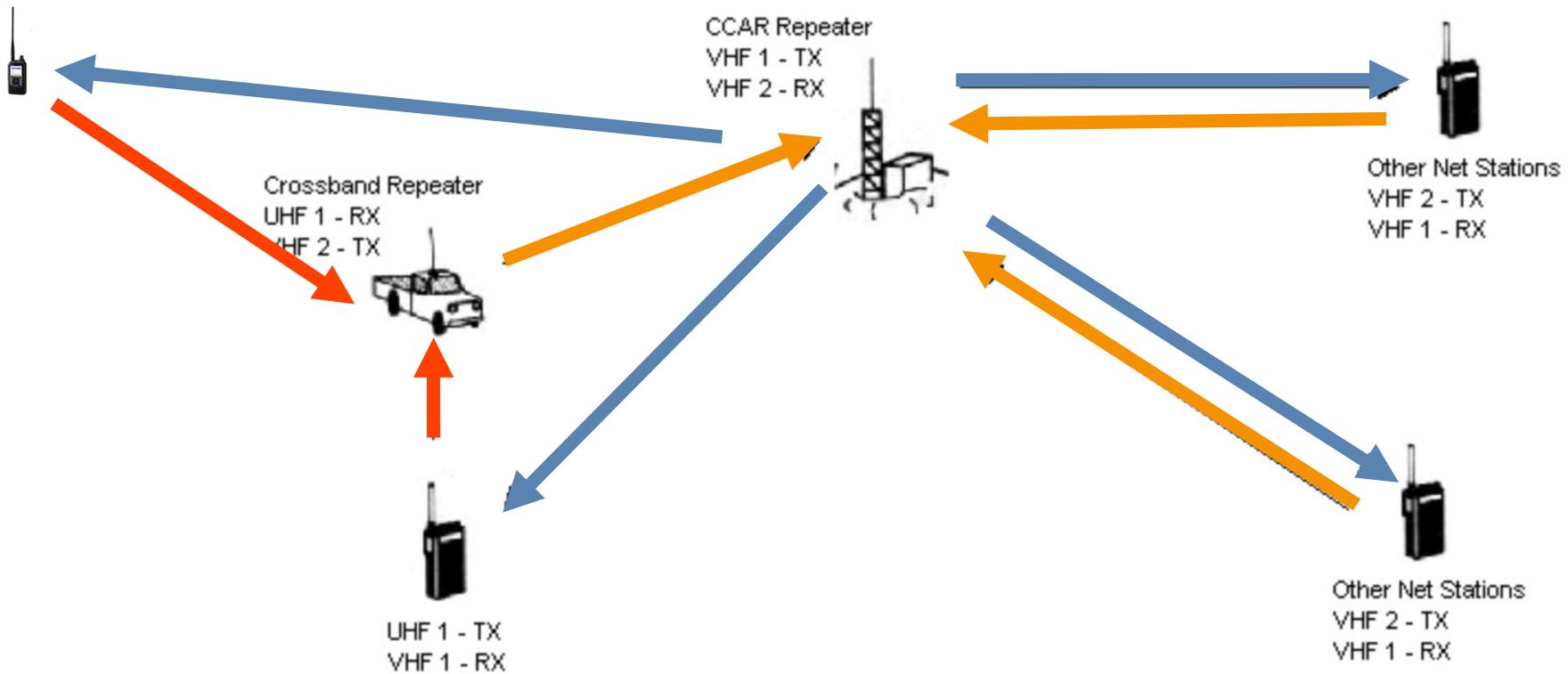


# One Way Repeat (esp. to a repeater) saves X-band radio from too much transmitting

The HT receives all the repeater traffic  
but the X-band radio only transmits when  
the designated HT transmits (single duty)

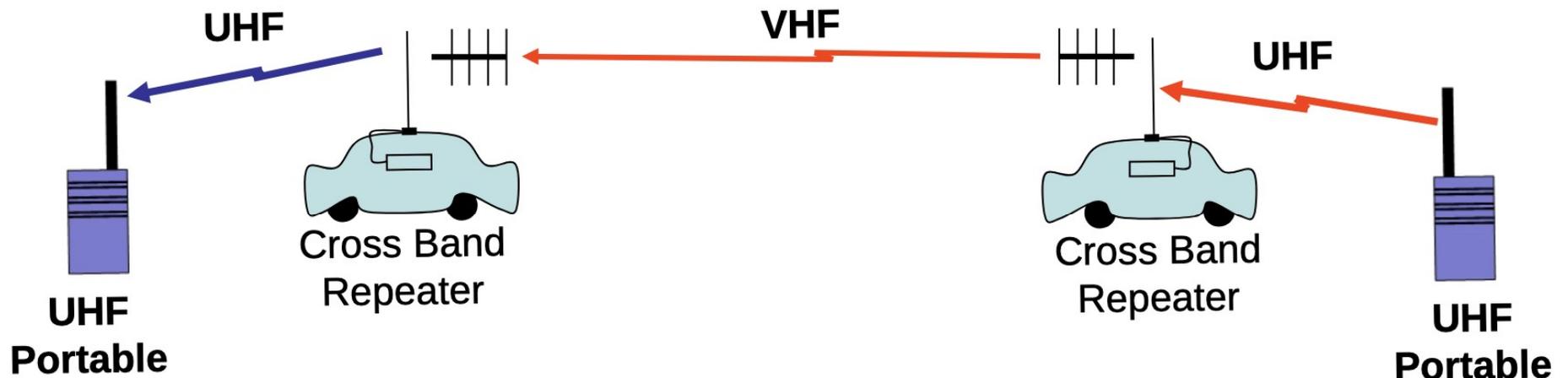


# One-Way Two-Way



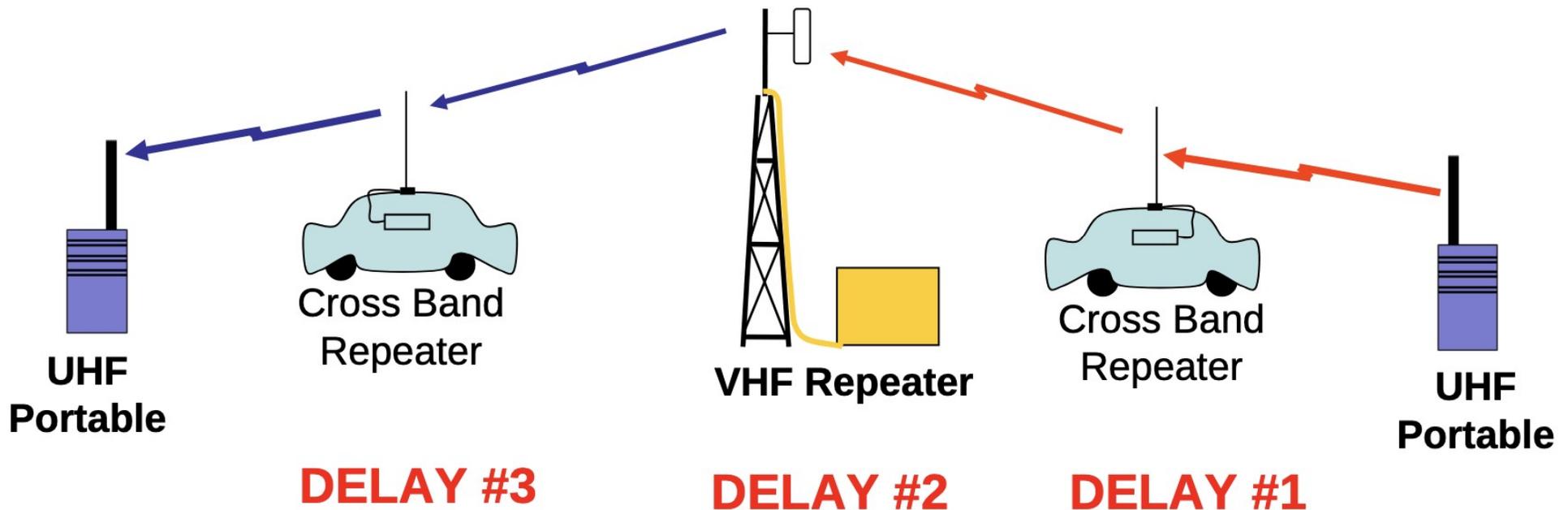
**Range Extender Crossband Repeat**

# Two crossbands for extended simplex



From: [www.emrg.ca/EMRG-403\\_Crossband\\_Repeaters.pdf](http://www.emrg.ca/EMRG-403_Crossband_Repeaters.pdf)

# Two Crossbands from a Repeater expect even more lag b/n transmissions



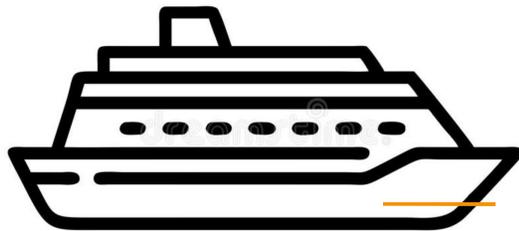
From: [www.emrg.ca/EMRG-403\\_Crossband\\_Repeaters.pdf](http://www.emrg.ca/EMRG-403_Crossband_Repeaters.pdf)

# Crossband in HF Bands?

Yes, especially between ships at sea.

Allows for semi-duplex communication, across a long distance, with reduced interference.

RX set on 8MHz band  
TX in USB set on 16MHz  
band



RX on 16MHz band  
TX on 8MHz band



\*\*\* frequency separation is important (4MHz, 8MHz, 12MHz, 16MHz)

# Is Crossband Used in Digital?

Yes, most digital radios have cross-band capability in

- analogue A-to-A
- digital D-to-D (DMR, D-Star, system fusion)
- Or possibly A-to-D, D-to-A, or both

# When in heavy use

- set lowest power that works on X-band and HTs
- keep transmissions short (set the Time Out for 2 min.)
- use one-way repeat through the X-band radio, if possible
- use better antenna
- provide good air flow, shade, & possibly an external fan blowing across the radio

# More considerations

- maximum **one** tower repeater (e.g. do NOT set up crossband between our 78 repeater and the Island Trunk... ping-ponging)  
pre-program radios; ideally, set up a tone/CTCSS (ex. 141.3 Hz)
- pre-test locations, when success is critical
- X-band can require double the TX & double the battery drain (or MORE)
- take care of squelch so there is no noise (that it would re-transmit)
- test before leaving it alone
- if the crossband radio stops transmitting, it may need to cool for half an hour from overheating (or has used up the battery)
- exit crossband repeat function when finished

# Some X-band radios

**Crossband radios cost more, but are often combined with more functions (ex. APRS)**

- Iradio UV-98 plus (HT) (\$95 CAD - AliExpress)
- RadTel RT-880 (HT) (\$120 CAD - AliExpress)
- Wouxun KG-M70 (mobile) (\$165 CAD - AliExpress)
- Icom IC-2730A (mobile) (\$430 CAD)
- Yaesu FTM-150R (mobile) (\$500 CAD)
- Alinco DR-735T (mobile) (\$525 CAD)

## **Example crossband radios in CVARC**

- Anytone AT-D-578UVIII Plus (mobile) - Janis      Anytone AT-D878 (HT) – Peter

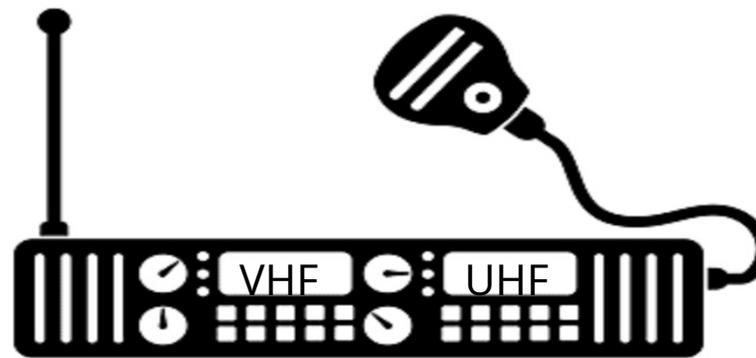
# Demo A – Crossband with FM Simplex

Ht - 1

Set VFO to  
**146.55 MHz**



**Remind Janis** All radios  
LOW power



Ch A: 146.58  
RX & TX

Ch B: 446.175  
RX & TX

HT - 2

Set VFO to  
**446.175 MHz**



\*2m band plan (FM simplex)  
146.4 – 146.595 MHz  
@ 15kHz

\*70cm band plan:  
446.0 – 446.175  
@ 25 kHz

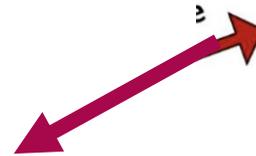
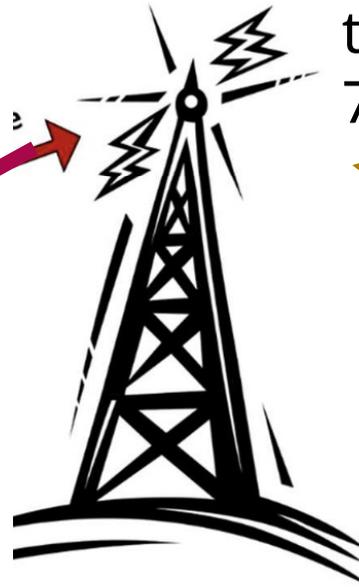
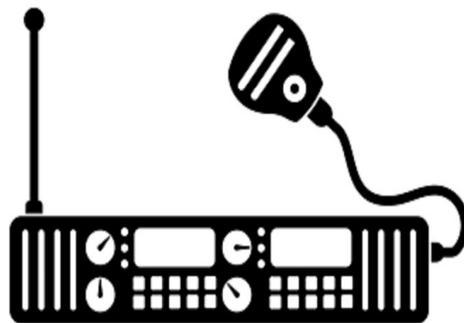
# Demo B – Crossband to Repeater

HT on LOW power  
Stay inside  
Set VFO to  
446.175 MHz

**Remind Janis**

<-- inside HT to use LOW power

HT- take outside  
on HIGH power to  
transmit through  
78 repeater



Ch A:  
446.175  
RX & TX

Ch B:  
RX 146.78 MHz  
TX 146.18 MHz (Tone 141.3)

# DEMO C: Repeater Box



Pair of Baofengs acts as a X-band repeater

UHF

Radio A:  
UHF



Radio B:  
VHF, ideally with  
better antenna

Radio repeater  
box with K-heads  
(\$30 CAD)

