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Crossbanding -

- applications,
- considerations and
- cautions

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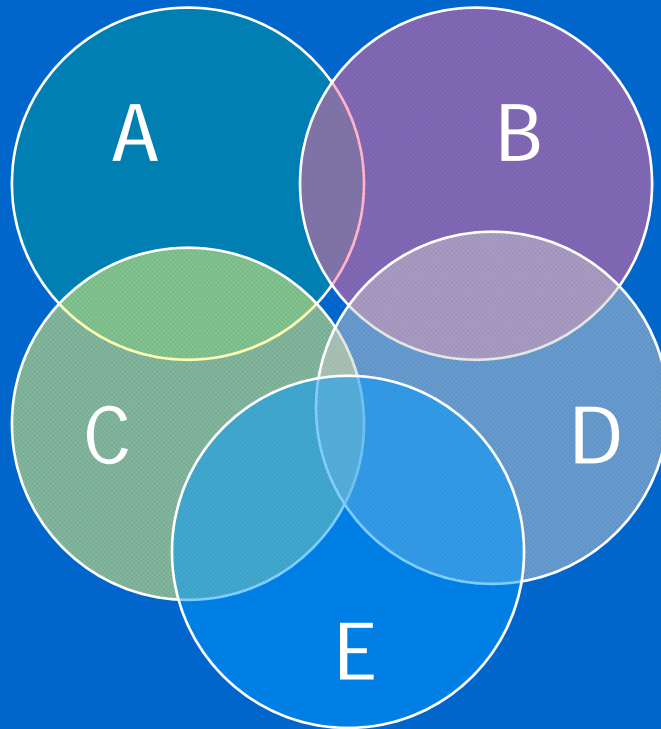
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Simplex radio communications:

- Single frequency for TX and RX
- radios talk directly to each other
- cannot achieve good range due to obstacles, terrain
- line of sight at VHF or UHF
- Out of a group of radios, only those within range of each other can communicate
- A benefit is no single point of failure (repeater)



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Simplex Limitations:

A can talk to B and C

B can talk to A and D

No one person can talk to everybody - difficult for coordinated group exercises

Relies on relaying of messages which doubles or triples time and increases errors



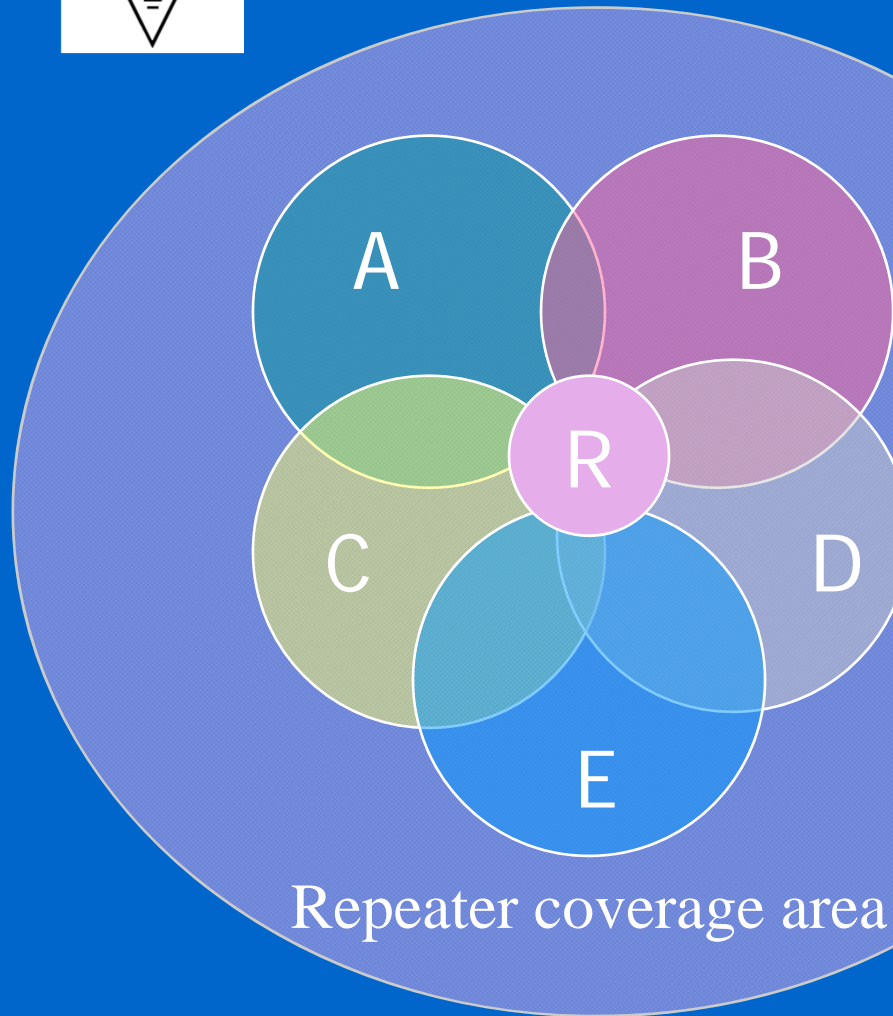
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Half Duplex (via Repeater) communications:

- Two frequencies used, one for TX and one for RX
- All radios TX on one frequency
- All radios RX on another frequency
- Radio's cannot hear each other directly, even if they are right next to each other!
- The repeater listens on the radio TX frequency, and retransmits the signal on the radio RX frequency
- Better range due to high location - line of sight
- The repeater is essential for comms (failure point)



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A, B, C, D, E all talk to the repeater

A, B, C, D, E all hear the repeater

All can talk to AND hear each other, even if they are not in range of each other

Coverage area is greatly increased



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Wide area event coverage

- Special events need specific coverage of the course of the event
- Crossbanding can be put to good use to cover dead spots on the extremities of the course
- Ideal is to make use of a full duplex repeater as the HUB, and even better if this has NO SQUELCH TAIL
- Crossbanding also allows convenient use of handhelds at the VOC



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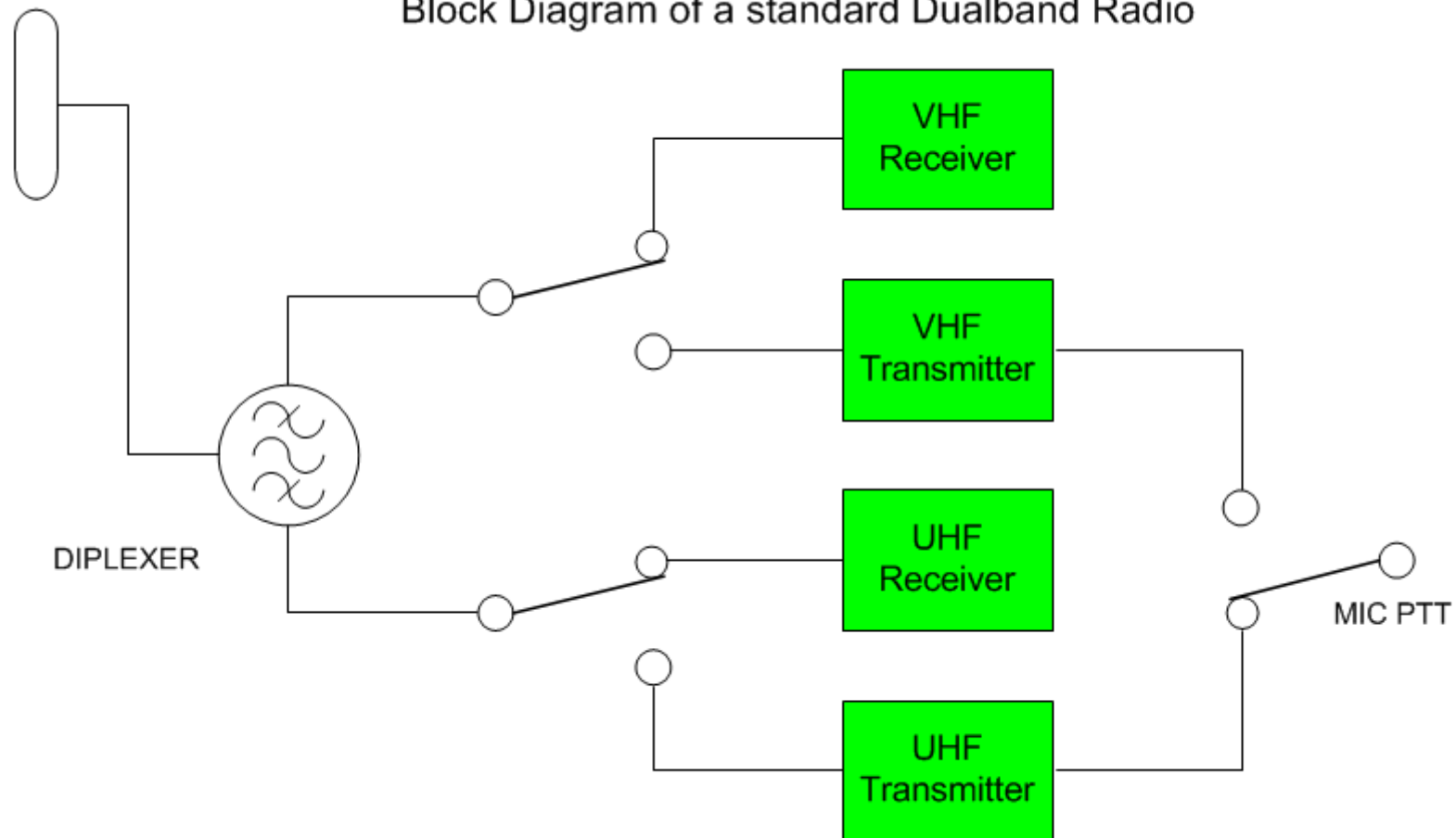
Dualband mobile radio:

- Can communicate on at least 2 bands, usually VHF and UHF (there are some 3 and even 4-band versions)
- Can RECEIVE on both bands simultaneously, OR receive on one and transmit on the other
- But can only TRANSMIT on ONE band at any time
- User switches the active TX band between VHF and UHF as required.
- Always half-duplex - while transmitting, the same band receiver is dead, but the other band receiver is active and can receive



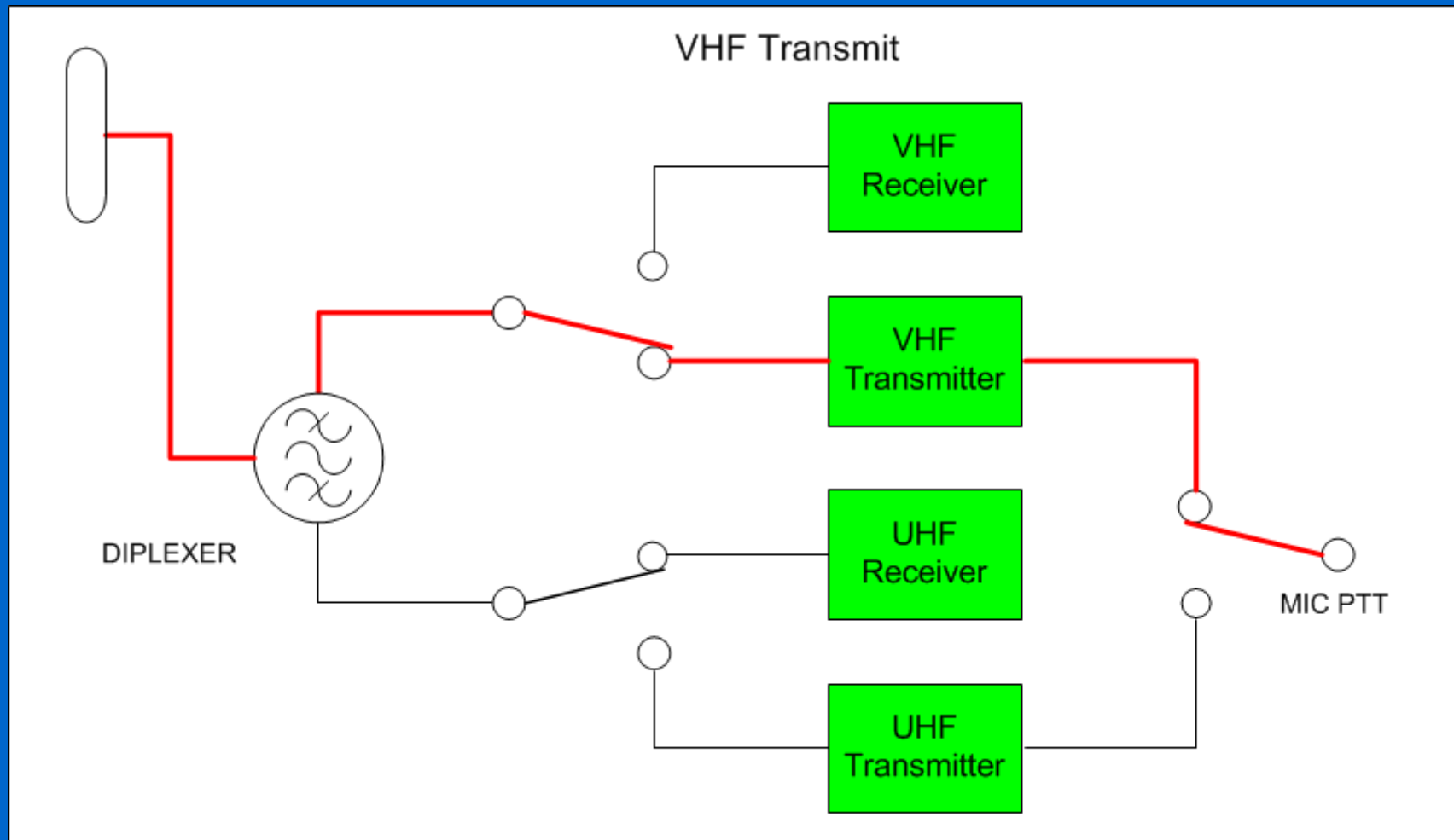
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Block Diagram of a standard Dualband Radio



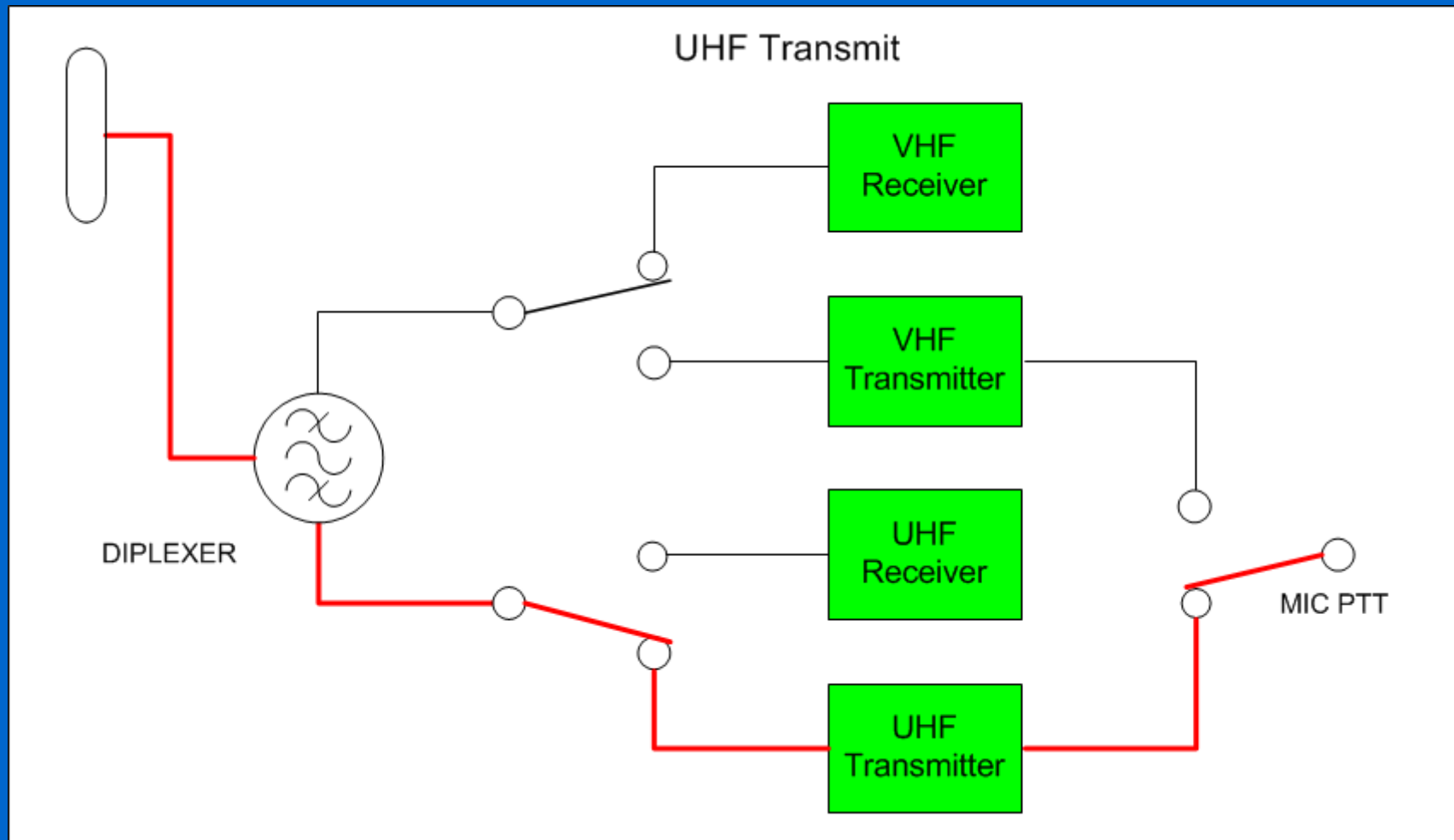


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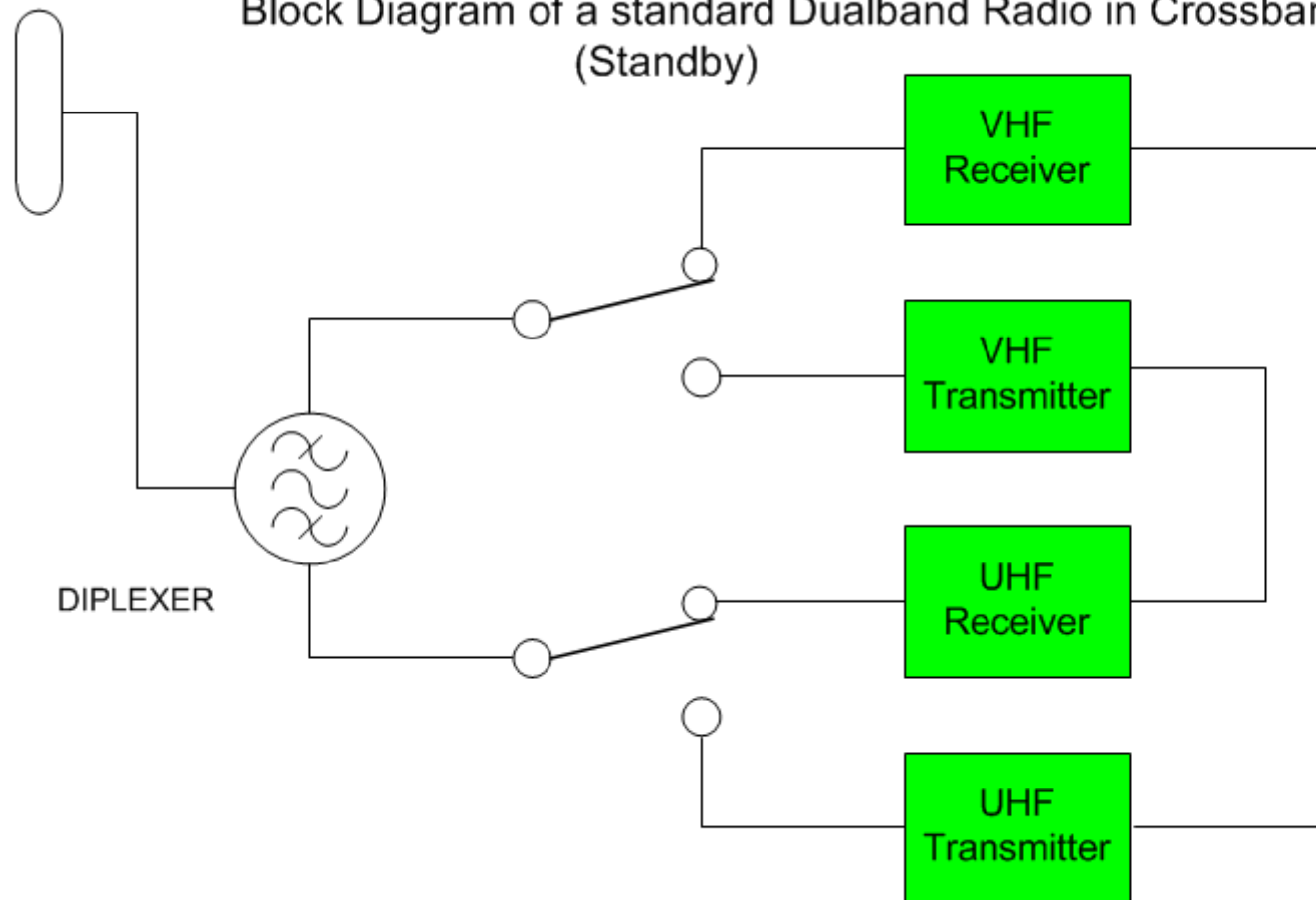
Dualband mobile radio in CROSSBAND mode:

- Both receivers listen in standby mode
- Any open squelch causes the OTHER band to TX, and mutes the other band RX
- Audio is transferred
- There is a certain switching delay to reverse the arrangement
- When a band is transmitting, it cannot receive, so a reversal CANNOT be forced



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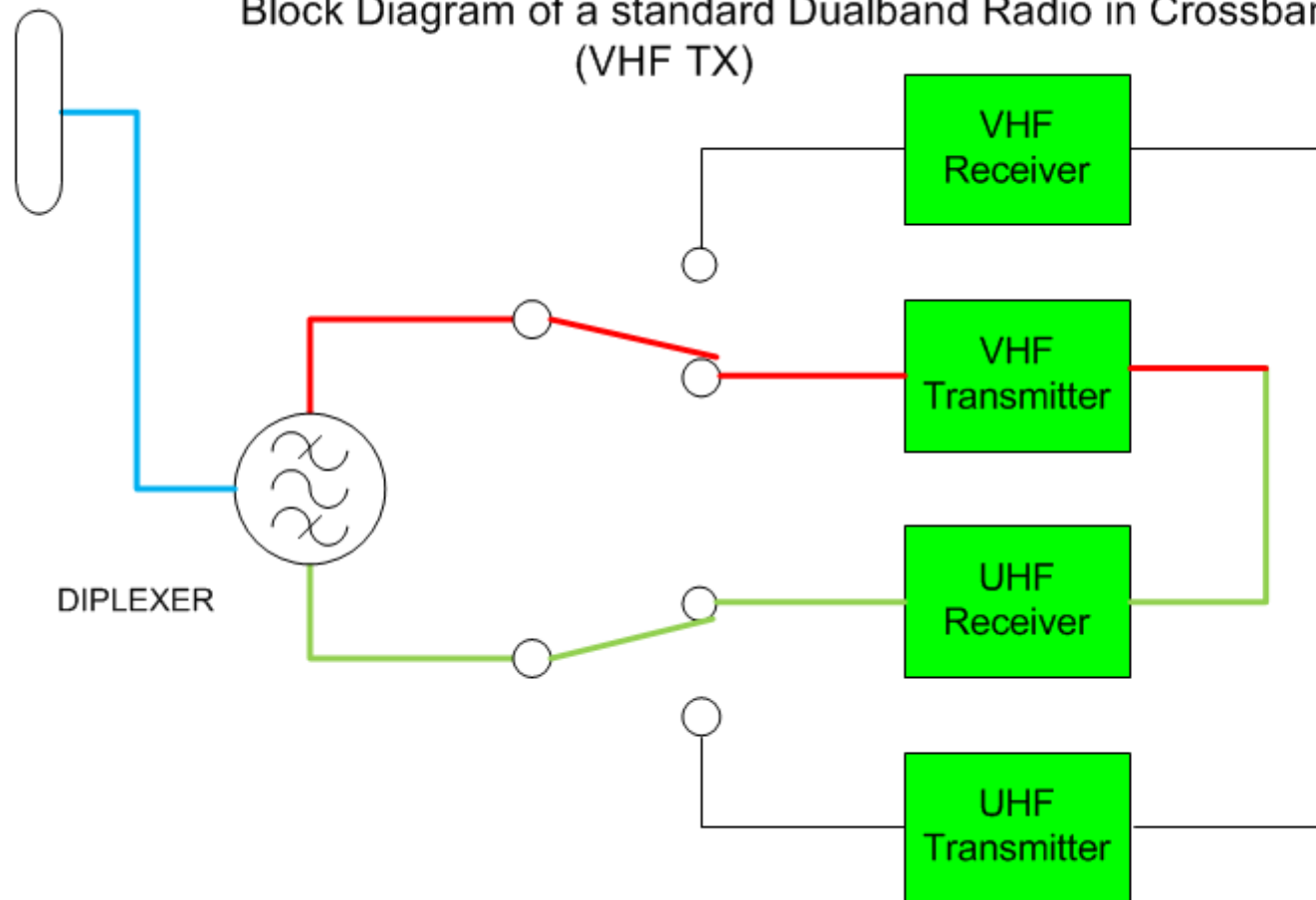
Block Diagram of a standard Dualband Radio in Crossband mode
(Standby)





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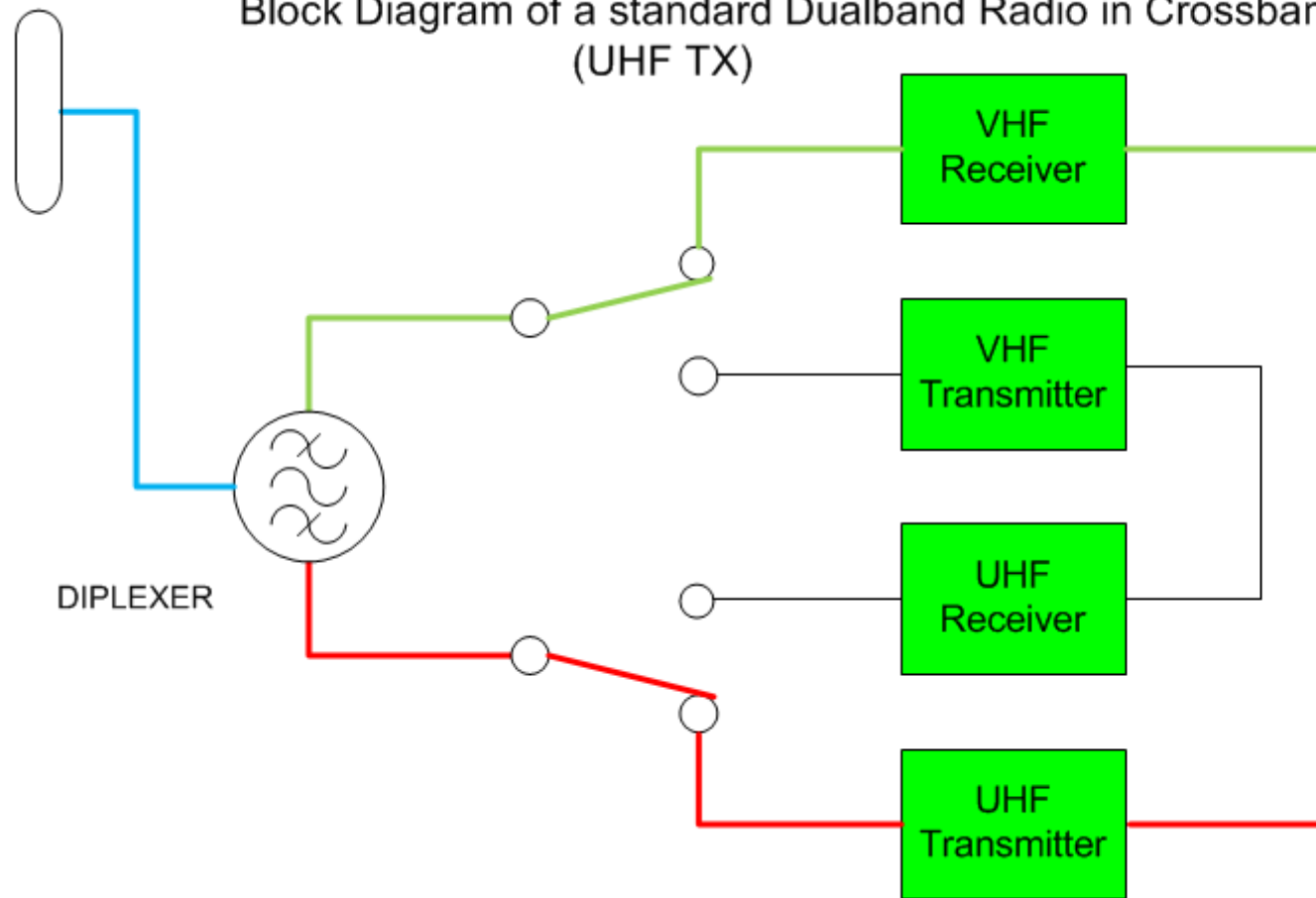
Block Diagram of a standard Dualband Radio in Crossband mode
(VHF TX)





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Block Diagram of a standard Dualband Radio in Crossband mode (UHF TX)





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Implementation

- All sites within range of the central repeater, make use of it directly
- Any site NOT within range, make use of a crossband site to reach the network
- This crossband site can either be another checkpoint or a standalone site
- Manned sites preferred to act as crossband sites, since they are monitored and can be attended to if there are problems



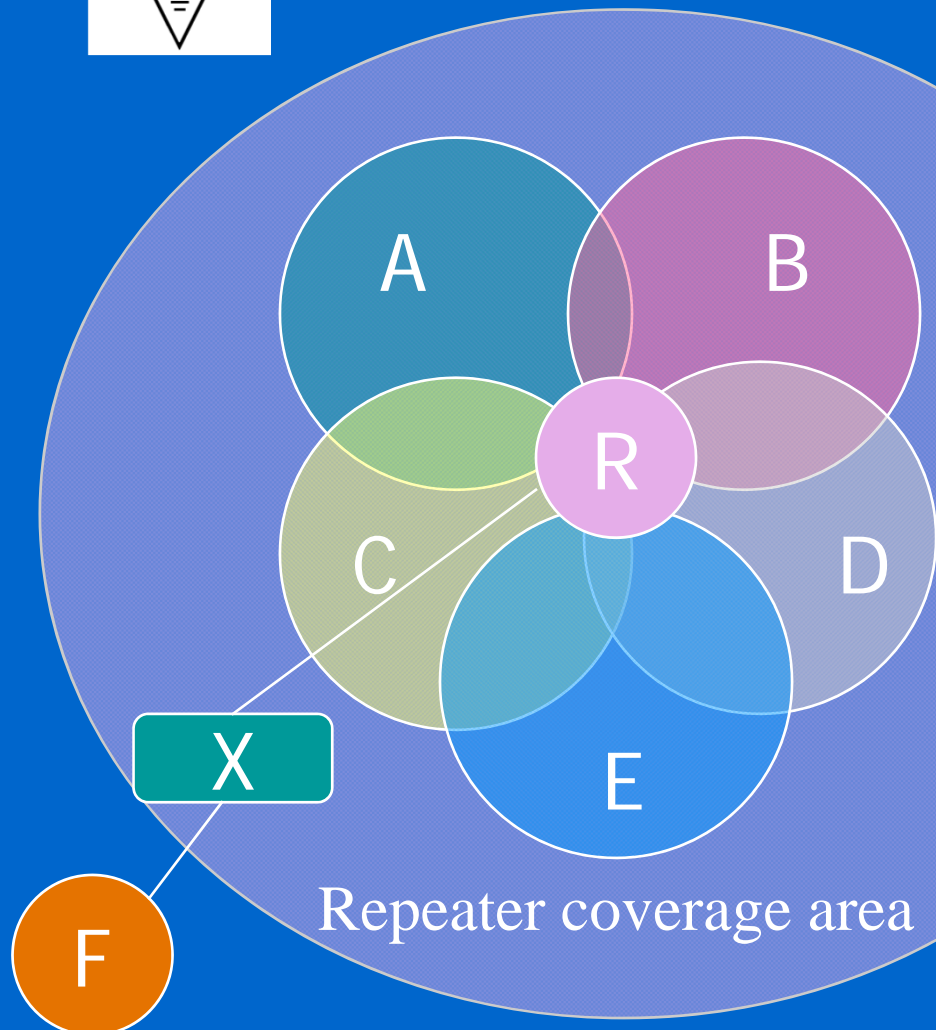
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Implementation cont'd

- Added interference rejection can be implemented by using DCS or CTCSS on the local (downstream) frequency, but this adds decode time delays.
- 25kHz or 12.5kHz settings will depend on the central repeater, and the crossband rig's configuration options. UHF will remain 25kHz for the foreseeable future. VHF will change to 12.5kHz ASAP.



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For a site F, a crossband setup at X can bring it into the network repeater R

All stations can then also hear and communicate with F

The crossband function can be performed by another station such as C or E, if they can communicate with F



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Cautions for crossbanding

- No two crossband sites can use the same LOCAL frequency, as this can cause lockups – see the allocation table on the web page (next 2 slides)
- Crossband radios **MUST** have tight squelch settings
- Crossband radios to be set to LOW power
- Switching delay/tails should be removed in the crossband radio's configuration
- Beware that some radios (Kenwood?) have a LIVE MIC when actively transmitting in crossband mode – **UNPLUG** the mic!!



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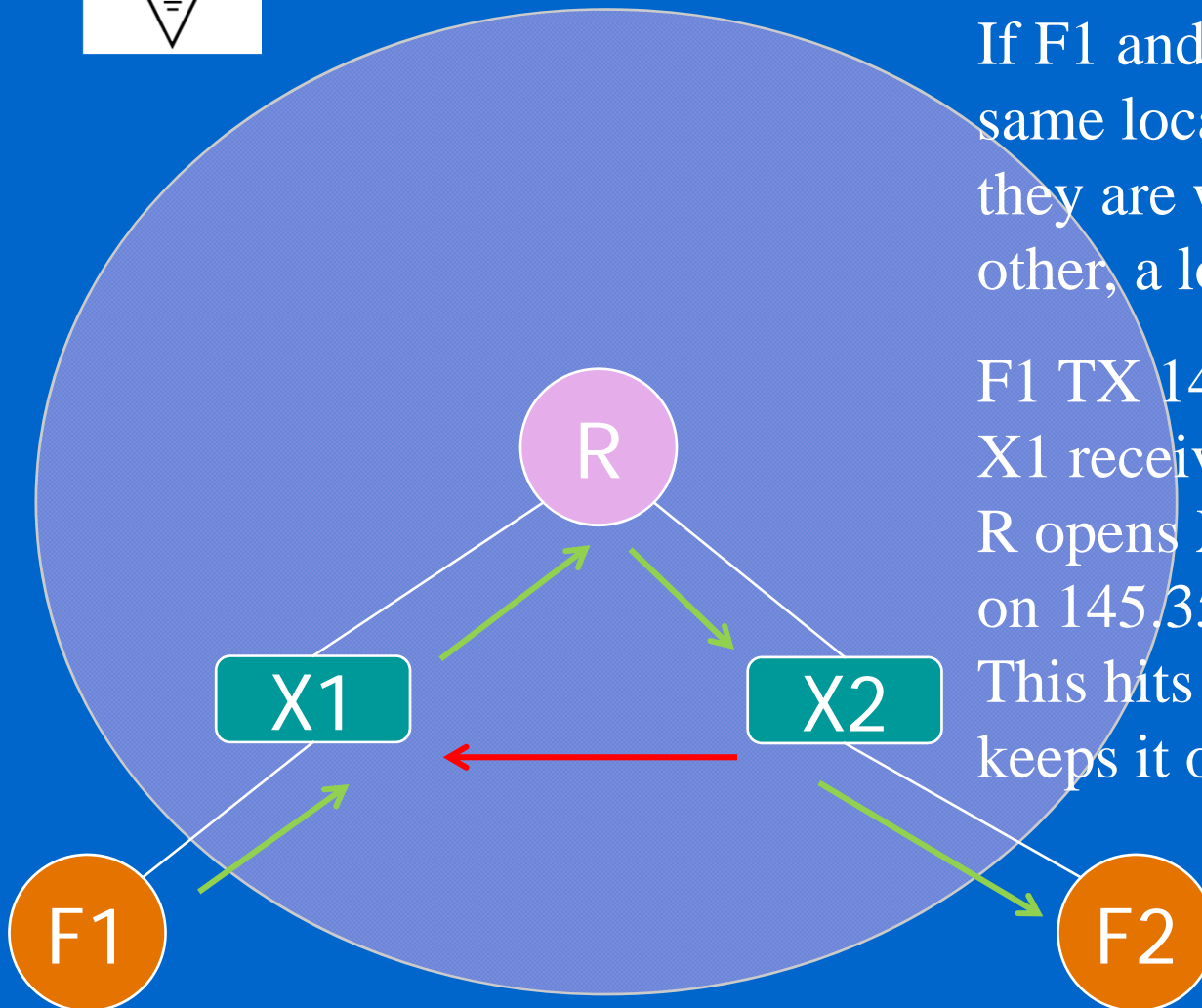
If F1 and F2 are set to the same local use frequency, and they are within range of each other, a lockup will occur:

F1 TX 145.350

X1 receives and opens R

R opens X2 and it sends out on 145.350

This hits X1 receiver and keeps it open





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PAIR No:	VHF	UHF	Name	Callsign
CR1	145.300	433.400	Beavan	ZS2RL
CR2	145.325	433.425	Les / Michael	ZS2VA / ZS2MDL
CR3	145.350	433.450	Glen	ZS2GV
CR4	145.375	433.475	Tony	ZR2TX
CR5	145.400	433.500	Colin / Jimmy	ZR2CRS / ZS2JIM
CR6	145.425	433.525	Andre / Andrew / Richard	ZS2BK / ZS2G / ZS2RA
CR7	145.450	433.550	Micho / Dave	ZS2MD / ZS2DH
CR8	145.475	433.575	John / Gert	ZS2GB / ZS2GS



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Cautions for crossbanding cont'd

- The local frequency should always be a **SIMPLEX** channel so that more than one downstream user will hear others on simplex, using the crossband.
- Confusion **WILL** result when simplex is used, if **ALL** the downstream users can't hear each other on simplex
 - they will tend to talk over others already busy talking via the crossband unit



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Cautions for crossbanding cont'd

- If crossbanding towards a repeater **WITH** a squelch tail, the downstream crossband user has to wait for the end of the over **AND** the end of the squelch tail, before he/she can reply – this adds delays, and is not optimum for the Control centre
- Any lock-ups of the network due to stuck mic syndrome, renders the crossband downstream user locked-out , due to the direction of transmission, they cannot reply to the network



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Cautions for crossbanding cont'd

- A UHF and a VHF repeater network CAN be linked via a crossband unit, provided that at least ONE of the repeaters does NOT have a squelch tail, otherwise permanent kerchunking will result.
- A full duplex VHF repeater with associated UHF link is superior because it can do both directions simultaneously, and should be the centre of the communications network when possible.



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Actual use case scenario:

- Zuurberg UHF repeater (438.600) forms the hub for the Herald MTB and Zuurberg Great Trek events.
- GV special UHF repeater (438.625) forms a hub deep in the Baviaanskloof, and is linked off Longmore, for the Trans Baviaans MTB race.
- Both Zuurberg UHF and a second VHF repeater in the Kabouga area, with a crossband linking them together, will form the network for the Addo Trail Run.



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Questions?

Thanks

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