SAR Communication Options

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SAR Communication Challenges

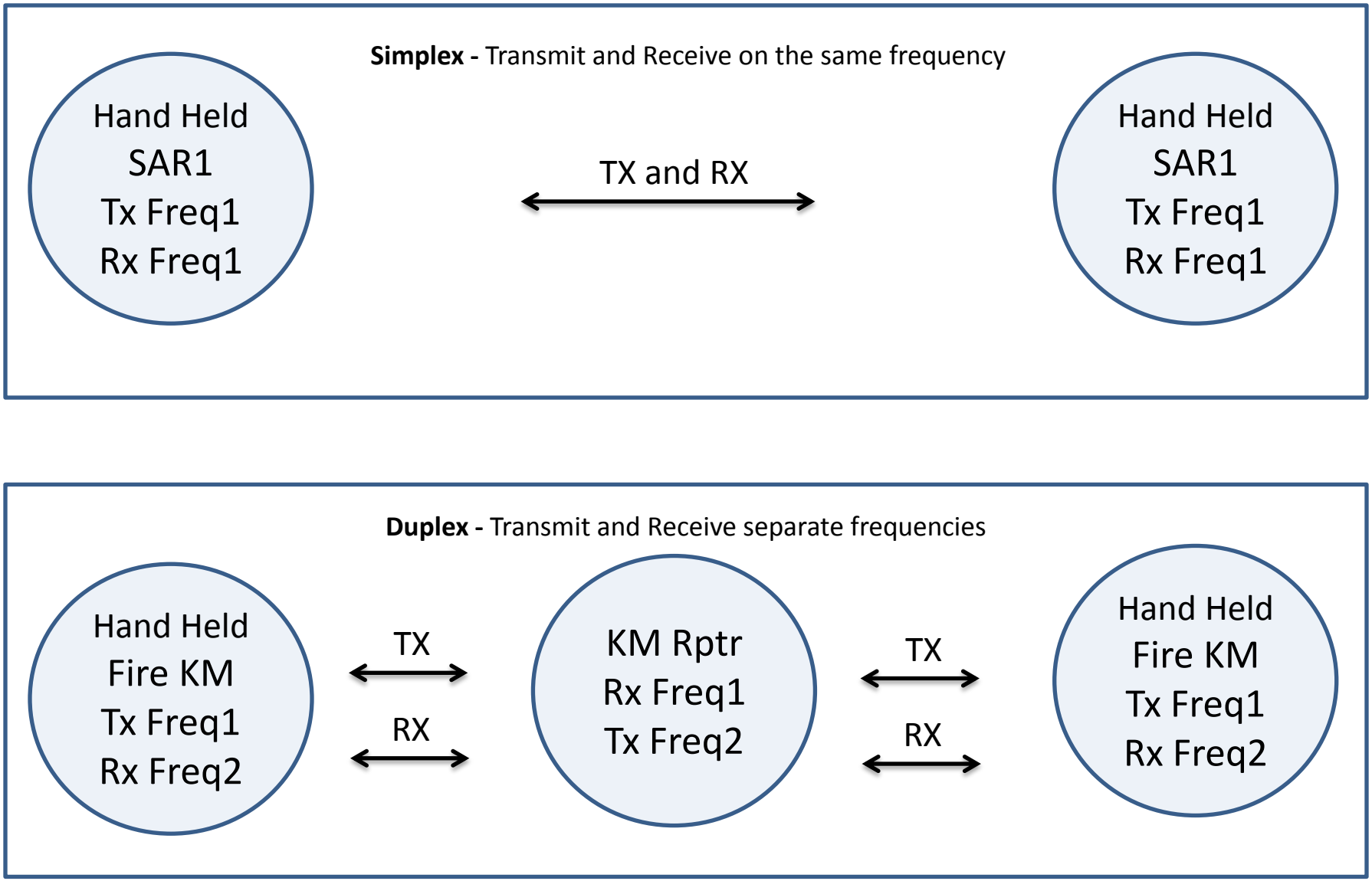
- Communication within a Wahkiakum SAR sub-team, between sub-teams, from sub-teams to SAR Base
- Communication between disparate SAR agencies e.g. Wahkiakum SAR, Cowlitz SAR, Pacific SAR, etc.
- Communication between SAR groups and other agencies e.g. Law Enforcement, Coast Guard, Department of Natural Resources, Fire/EMS, LifeFlight
- Communication between SAR Base and Dispatch

SAR Communication
Lessons from Mt. St. Helens

- Main Frequency in use was State SAR.
- Required relays to communicate between SAR Base and the various SAR teams
- There was the desire to monitor more frequencies than SAR Base could effectively monitor (State SAR, L TAC1, VTAC 14, King County SAR, GMRS?)
- Every group moved off to their own frequencies once the lost person was found, SAR Base was out of the loop, frustration and confusion all around.
- Issue with GPS Coordinate systems WGS vs UTM

SAR
Equipment Options

- Portable EOC Cross Band Repeater (No Programming)
- Portable EOC True Repeater (Requires Programming)
- Existing Network of Ham Radio Repeaters
- GMRS True Repeater


Simplex - Transmit and Receive on the same frequency
Hand Held
SAR1
Tx Freq1
Rx Freq1
TX and RX
Hand Held
SAR1
Tx Freq1
Rx Freq1
Duplex - Transmit and Receive separate frequencies
Hand Held
Fire KM
Tx Freq1
Rx Freq2
TX
RX
KM Rptr
Rx Freq1
Tx Freq2
TX
RX
Hand Held
Fire KM
Tx Freq1
Rx Freq2

Repeaters

Repeaters extend the range of communications several ways:

1. They re-broadcast signals from a distant location
2. They re-broadcast with higher power levels (40+ watts vs 5 watts) and better antennas
3. They can be strategically positioned at higher elevations

True Repeater
vs
Cross Band Repeater

- In a True repeater Tx and Rx frequency pairs are reasonably close together and require a “duplexer” to keep the transmit signal out of the receive path.
- In a Cross-band repeater the frequency pairs are separated into completely different bands to keep transmit signal out of the receiver
- The EOCs cross-band repeater is a hybrid where Tx and Rx are in the same band but use completely different radios and different antennas to help with isolation

EOC Cross Band Repeater (In Beau's Office)

- Designed to allow a remote base to communicate with a Wahkiakum County repeater (Fire/EMS or Sheriff's).
- Two mobile radios are connected together (mic of radio 1 to speaker of radio 2 and vice versa). Each radio has it's own antenna.
- Radio 1 is set to a County repeater, Radio 2 is set to a Simplex channel such as SAR3.
- Everything heard by the county repeater is sent to SAR3 and everything heard on SAR3 is sent to the county repeater

EOC Cross Band Repeater

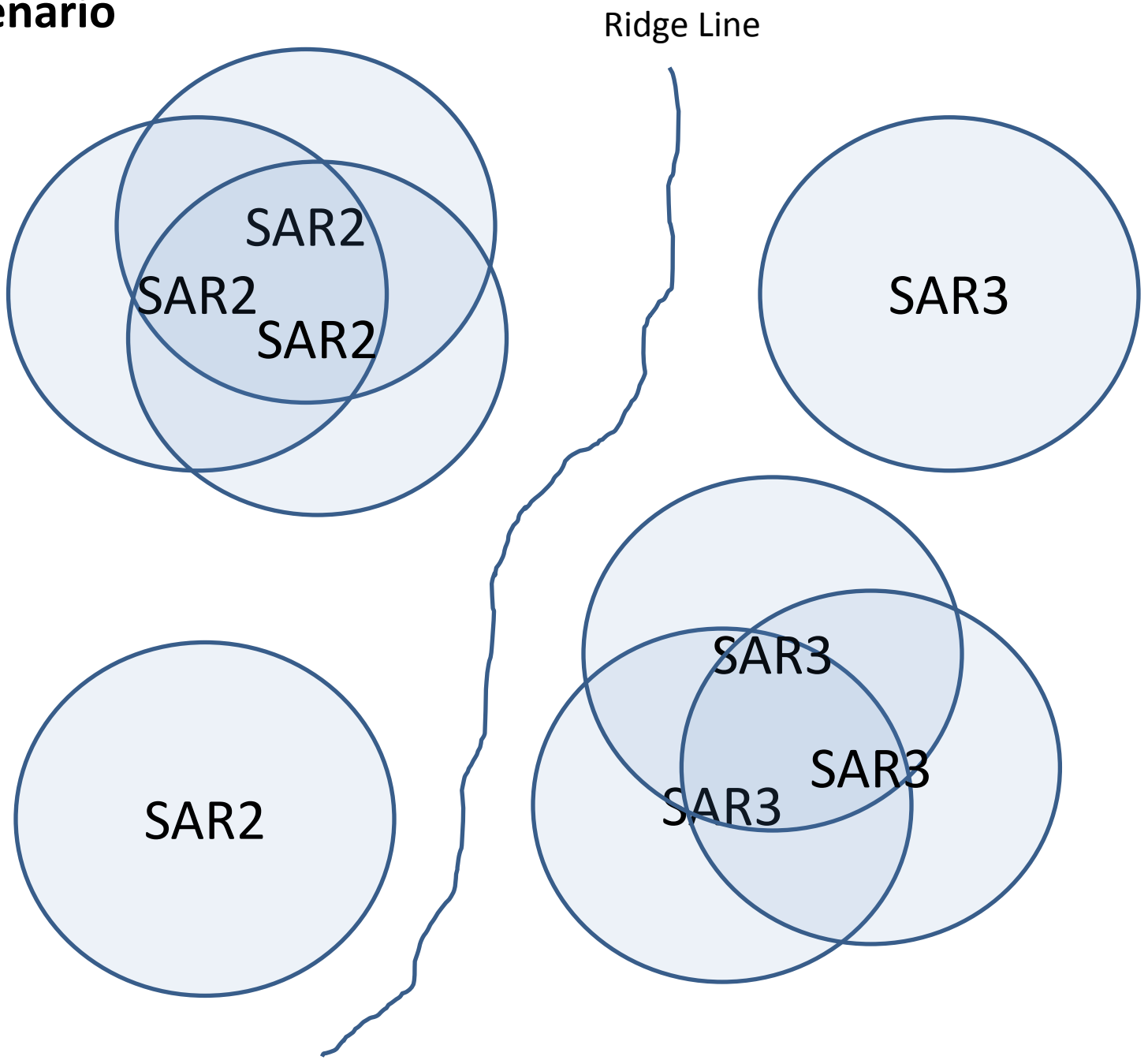
Could also be set up on two simplex Channels

- Radio 1 set to SAR1, Radio 2 set to SAR2
- Now team 1 communication can be heard by team 2 and vise versa (over the hill)
- **However the communication range within a team (team 1 to team 1 or team 2 to team 2) has not changed.**

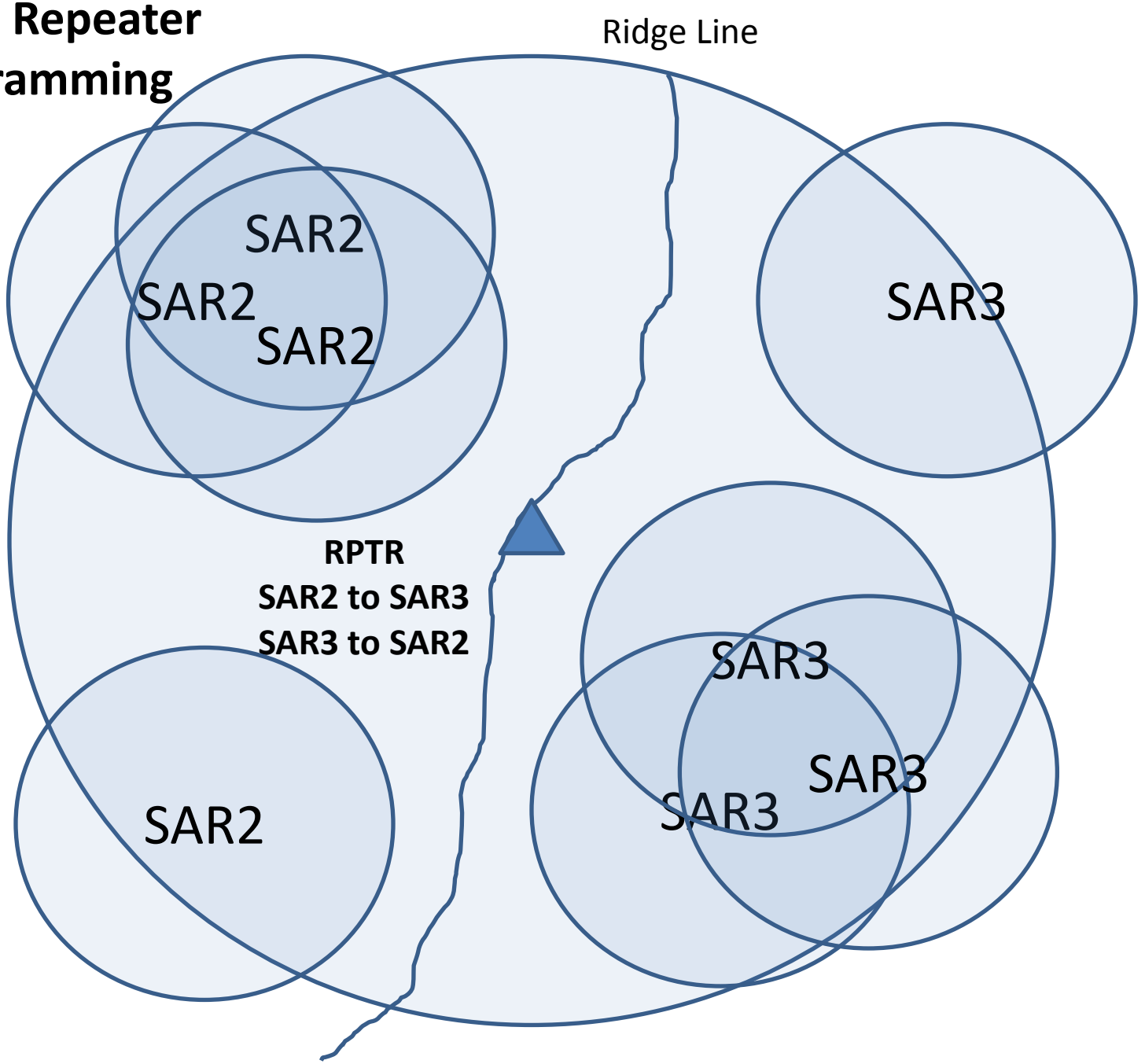
True Repeater

- A “True Repeater” is required to extend the range within a team and across teams.
- This may be possible using our portable repeater if the radios are reprogrammed. This would need to be tested.

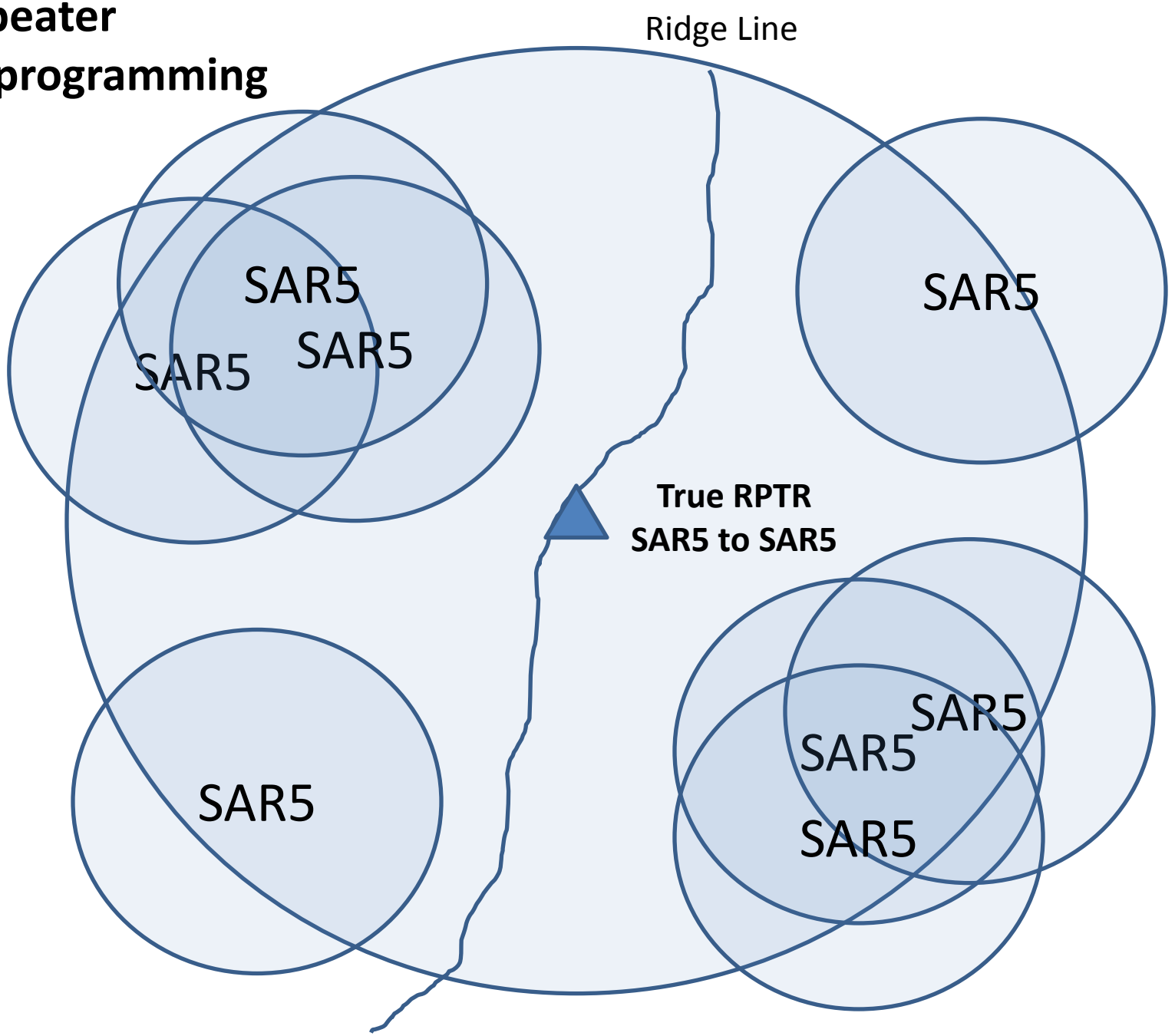
Current Scenario



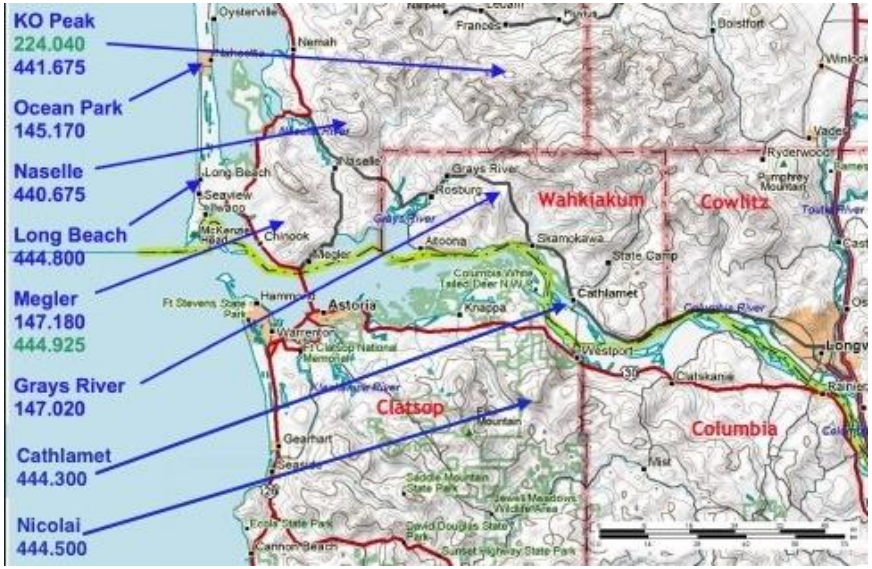
Cross-Band Repeater
No Reprogramming



True Repeater
With Reprogramming



Use Existing Network Of Amateur Radio Repeaters



BeachNet Linked Repeaters

Columbia Pacific Amateur Radio Network

SAR Options
Equipment Options

- Portable EOC Cross Band Repeater (No Programming)
  - Positive - Can utilize today. Extends range between teams.
  - Negative - Communication range within team is not extended
- Portable EOC True Repeater (Requires Programming)
  - Positive – Communication range within and across teams extended.
  - Negative – requires proof of concept testing and expenditures for reprogramming.
- Existing Network of Ham Radio Repeaters
  - Positive – Available today, fairly complete coverage of Wahkiakum County.
  - Negative – requires Ham radio operators in addition to SAR personnel.
- GMRS True Repeater
  - Positive – Fairly inexpensive equipment for both hand held radios and true repeaters. License required but no test is involved. No additional personnel required (hams). If used with Garmin Rhino units, then GPS coordinates of stations are also available to all.
  - Negative – Requires second radio within teams and SAR Bse. Expenditure for radios and repeaters. Possible conflicts with other public use (frequencies are open to all). Additional frequency to monitor at SAR Base.

SAR Personnel Options

- Augment SAR base with Ham personnel in order to manage more frequencies and provide “net-control” communication relief
- Utilize Ham personnel to man relay stations (best if can be done from a 4WD vehicle with better radio and antenna on SAR frequencies).
- Utilize Ham personnel within SAR sub-teams
- Utilize Dave Basham and Dale Costich for Drone Searches (Part 107 Licensed Pilots). For larger searches utilize the Cowlitz County volunteer drone team with FLIR and waterproof drones.

Ham Radio for Public Service

- It is not legal to use Ham certified radios on non-ham frequencies.
- Most ham radios can be modified to transmit on non-ham frequencies however it is still not legal.
- Most ham radios are not capable of narrow band operation. There are effectively three bandwidths:
  - Wide band – used by FM Radio Stations
  - Narrow band – used by FM Amateur and Marine Band Radios
  - Even Narrower band – used by public service radios
- Cheap Chinese radios do support “even narrower band” but are still illegal for use on non-ham frequencies (not certified for public service).

Wahkiakum County Radios
Zone 1- Zone 4

Zone 1 Fire/EMS	
1	FIRE/EMS KM
2	FIRE/EMS Radar
3	FIRE/EMS East
4	FIRE/EMS Direct
5	FIRE/EMS Wickiup
6	Wahkiakum Tac1
7	Wahkiakum Tac2
8	Wahkiakum Tac3
9	Cowlitz OPS 2
10	HEAR
11	AMR Ambulance
12	WSCO Direct
13	PubWks Direct
14	Naselle Amb
15	Fire Veh Rpt
16	Fire/EMS Pager

Zone 2 WCSO	
1	WCSO KM
2	WCSO Radar
3	WCSO East
4	WCSO Direct
5	WCSO Wickiup
6	FIRE/EMS KM
7	FIRE/EMS East
8	FIRE/EMS Direct
9	WSP
10	LERN
11	Cowlitz SO
12	PubWks Direct
13	WA State SAR2
14	Wahkiakum Tac3
15	USCG 22A
16	SO Vehicle Rep

Zone 3 Pub Wks/PUD	
1	PubWks Radar
2	PubWks KM
3	PubWks Cathlam
4	PubWks Direct
5	Wahkiakum Tac1
6	Wahkiakum Tac2
7	Wahkiakum Tac3
8	FIRE/EMS Direct
9	WCSO Direct
10	DNR COMMON
11	DNR Nicolai
12	DNR Abernathy
13	USCG 16
14	USCG 22A
15	Cowlitz PubWks
16	Fire Veh Rpt

Zone 4 Mutual Aid East	
1	FIRE/EMS KM
2	FIRE/EMS Radar
3	FIRE/EMS East
4	FIRE/EMS Direct
5	FIRE/EMS Wickiup
6	Cowlitz Ctrl 1
7	Cowlitz OPS 2
8	Cowlitz OPS 3
9	Cowlitz OPS 4
10	Cowlitz OPS 5
11	Cowlitz TAC 7
12	Cowlitz TAC 10
13	Cowlitz TAC 11
14	Cowlitz TAC 12
15	Cowlitz TAC 13
16	RED NET

Wahkiakum County Radios
Zone 5- Zone 8

Zone 5 Marine/Mics	
1	FIRE/EMS KM
2	FIRE/EMS Direct
3	WCSO KM
4	WCSO Direct
5	Marine 8
6	Marine 13
7	USCG 16
8	USCG 22A
9	Marine 23
10	Marine 68
11	DeBriaeWickiup
12	DeBriaeHuckber
13	Wahkiakum Tac3

Zone 6 DNR	
1	DNR Nicolai
2	DNR Signal
3	DNR TAC 1
4	DNR TAC 2
5	DNR AIR
6	DNR COMMON
7	DNR Abernathy
8	DNR Baw Faw
9	DNR Burley
10	DNR Capitol
11	DNR Defiance
12	DNR Hopkins
13	DNR Larch
14	DNR Kalama
15	DNR Mitchell
16	DNR Naselle

Zone 7 SAR	
1	WCSO KM
2	WCSO Radar
3	WCSO East
4	WCSO Direct
5	WCSO Wickiup
6	FIRE/EMS KM
7	FIRE/EMS Radar
8	FIRE/EMS East
9	FIRE/EMS Direct
10	FIRE/EMS Wickiup
11	WA State SAR
12	WA State SAR2
13	WA State SAR3
14	Cowlitz SAR3
15	Wahkiakum Tac3
16	WeatherAstoria

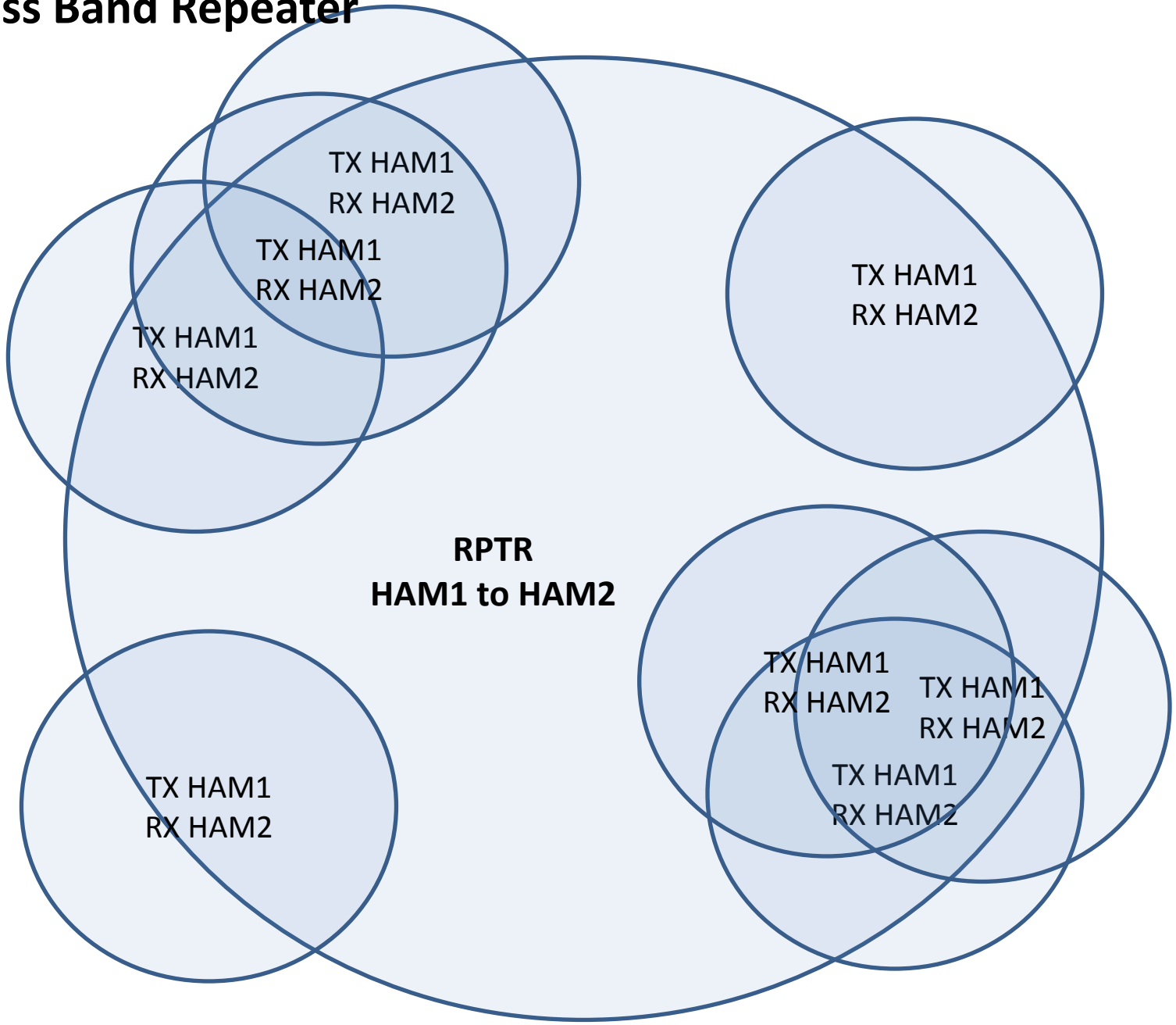
Zone 8 Reg4 Interop	
1	RED NET
2	LERN
3	V CALL 10
4	V TAC 11
5	V TAC 12
6	V TAC 13
7	V TAC 14
8	CLARK 8
9	Cowlitz OPS 4
10	Cowlitz TAC 4
11	HEAR
12	Marine 16
13	Marine 22A
14	WA State SAR
15	DNR COMMON
16	COMMAND 2

SAR Frequencies

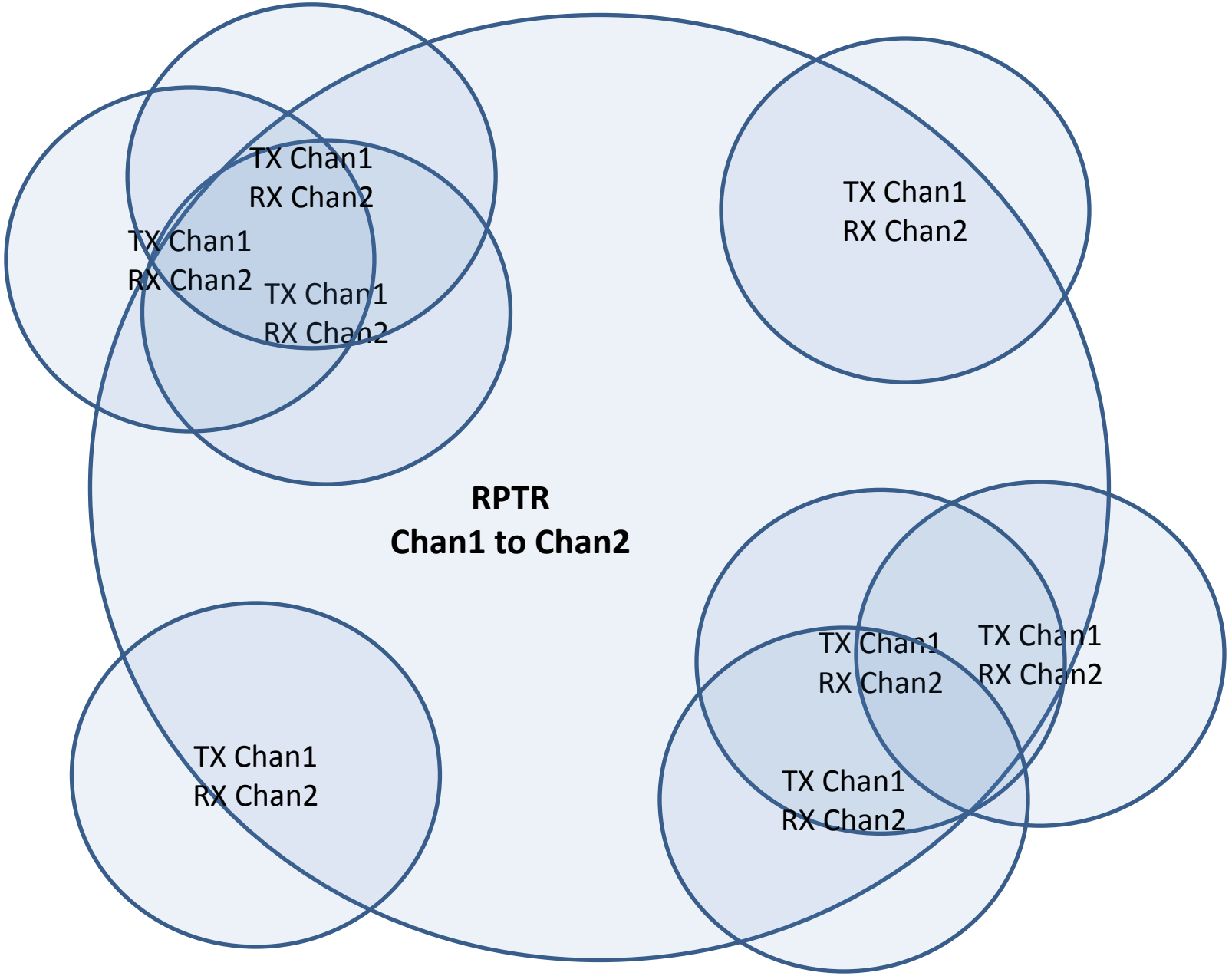
Location	Name	Receive Frequency	Transmit Frequency	Offset	Duplex	Tx Tone	Rx ToneFreq	T-DPL	R-DPL
Zone 7 SAR									
11	WA State SAR	155.1600	155.1600			156.7			
12	WA State SAR2	155.2425	155.2425			156.7			
13	WA State SAR3	155.3025	155.3025			156.7			
15	Wahkiakum Tac3	156.1800	156.1800			123.0	123.0		

BACKUP SLIDES

Ham Cross Band Repeater



GMRS Cross Band Repeater (General Radio Mobile Service)



GMRS True Repeater (General Radio Mobile Service)