Futurecom Systems Group, ULC

Introduction to VR
Primary/Secondary Feature

Document Revisions

Rev	Date	By	Notes & References
1.0	Jan 11, 2019	J. Price	Initial version
1.1	Jan 15, 2019	J. Price	Added some additional operation scenarios, control head icons
1.2	Dec, 2021	J. Price	Updates for GPS Driven Deactivation, Call Alert scenarios

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Feature Background

For a given agency with multiple VRs, the units can be programmed with one or more frequency pair(s) as transmit (Tx) and receive (Rx) frequencies. These pairs are then strapped to mobile talkgroups or conventional channels. As a result, there can be an event where multiple VRs are operational at the same time and on the same frequencies which will lead to interference. The advanced Futurecom Primary/Secondary feature automatically manages a scene where multiple VRs are present by assigning a single unit to be Primary. Only the Primary will transmit, and the remaining units are designated as Secondary.

The Primary/Secondary feature also promotes radio spectrum efficiency by allowing units that are at different scenes to use the same frequencies. The distance that determines whether scenes are separate is programmable on a per channel basis.

In addition to the standard fully automatic mode, the VR offers a manual override feature, Permanent Primary. This is typically used to select a particular unit for coverage or operational reasons.

Feature Overview

The Primary-Secondary feature ensures multiple VR units work together co-operatively when they are at the same scene. It does this by establishing one Primary VR and any additional VRs in the area become Secondary. The VRs communicate with each other to determine which VR will be the Primary, with all others remaining Secondary.

The first VR to be activated at a scene will look for another Primary unit within (programmable) range. Not seeing one, it assumes the role of the Primary unit and is responsible for handling all the calls at the scene. Subsequently activated units will see the Primary and remain in Secondary roles. If the designated Primary unit is deactivated or leaves the area, one of the Secondary units will automatically take over the Primary role.

For agencies where an automatic Primary assignment is not ideal, specific VR units can be optionally designated as Permanent Primary. This manual override feature allows a particular unit to be selected as Primary to provide optimal coverage or allow Command to assume communications control. A Permanent Primary VR forces the Primary active at the scene to become Secondary thus ensuring that only one VR is relaying communications.

Basic Operational Scenarios

There are three basic principles that apply to the Primary/Secondary feature:

1. If multiple VRs are activated at the same time, the Primary VR is selected randomly.
2. The first Primary VR at a scene will remain Primary—all VRs activated later will be Secondary.
3. A Permanent Primary VR at a scene will take over communication.

There are some exceptions and more complicated scenarios that can arise during operation and these are covered in the Alternate Operational Scenarios in the Appendices.

Scenario 1: VRs Arrive at a Scene at the Same Time

Two VRs arrive at a scene and are activated at the same time. No other VRs are within range. One VR will win the negotiations and become the Primary unit while the other VR will become the Secondary unit.

NOTE: Either VR could become Primary in this scenario—the Primary/Secondary feature determines which one.

SCENARIO 1: MULTIPLE VRs ARRIVE AT A SCENE AT THE SAME TIME	**RESULTING STATUS OF VR**	
	VR A	**VR B**
Step 1: VR A and VR B arrive at a scene and are activated at the same time. No other VRs are present. * Either VR A or VR B could become Primary	Primary*	Secondary
Step 2: VR A deactivates and leaves the scene. VR B becomes Primary.	N/A	Primary

Scenario 2: VRs Arrive and Leave Scene at Different Times

A single VR arrives at a scene and with no other VRs in range, it becomes Primary.

A second VR arrives next at the scene, detects the Primary VR and becomes Secondary. The Primary VR handles communications at the scene while the Secondary VR monitors the presence of the Primary.

The initial Primary VR is then deactivated and leaves the scene and the Secondary VR becomes Primary.

NOTE: If the initial Primary VR abruptly leaves the scene without being deactivated first, the result would be the same but it would take longer for the Secondary VR to become Primary.

SCENARIO 2: VRs ARRIVE AND LEAVE SCENE AT DIFFERENT TIMES	**RESULTING STATUS OF VR**	
	VR A	**VR B**
Step 1: VR A arrives first at a scene and is activated.	Primary	N/A
Step 2: VR B arrives next at the scene and is activated.	Primary	Secondary
Step 3: Primary VR A is deactivated and leaves the scene. Only Secondary VR B remains.	N/A	Primary

Scenario 3: Primary VR Leaves a Scene Leaving Multiple Secondary VRs

A Primary VR and two Secondary VRs are at a scene.

The Primary VR deactivates and leaves the scene. The two remaining Secondary VRs negotiate and one VR will become the Primary while the other remains as Secondary.

NOTE: Either VR could become Primary in this scenario—the Primary/Secondary feature determines which one.

SCENARIO 3: PRIMARY VR LEAVES A SCENE LEAVING MULTIPLE SECONDARY VRs	**RESULTING STATUS OF VR**		
	VR A	**VR B**	**VR C**
Step 1: VR A, VR B and VR C are all at a scene.	Primary	Secondary	Secondary
Step 2: VR A deactivates and leaves the scene. VR B and VR C remain at the scene. * Either VR B or VR C could become Primary	N/A	Primary*	Secondary

Scenario 4: Moving Primary VR Arrives at a Scene with Another Primary VR

There are two Primary VRs at two separate scenes. The Primary VR at the first scene drives away without deactivating first. The Primary VR arrives at the second scene where there is already another established Primary VR. The two Primary VRs negotiate and one VR will remain Primary while the other becomes Secondary.

NOTE: Either VR could become Primary in this scenario—the Primary/Secondary feature determines which one.

NOTE: The Primary/Secondary feature is typically intended for operation at stationary scenes only. VRs should not be active while the vehicle is moving—the VR must be switched OFF or a 'VR Disabled' MSU mode selected. This scenario is included to demonstrate what would happen at one particular scene, Scene1. However, there is the potential to impact Primary/Secondary behaviour at other scenes that are within range throughout transit—thus, moving vehicles should not have an active VR.
The GPS Driven Deactivation feature introduces scenarios where a VR can be moving while activated. Please refer to the VR Functional Description[1] for details on this feature and to APPENDIX C: GPS Driven Deactivation Operational Scenarios.

SCENARIO 4: MOVING PRIMARY VR ARRIVES AT A SCENE WITH ANOTHER PRIMARY VR	**RESULTING STATUS OF VR**	
	VR A	**VR B**
Step 1: VR A arrives at Scene 1 and is activated.	Primary (Scene 1)	N/A
Step 2: VR B arrives at Scene 2 and is activated.	N/A	Primary (Scene 2)
Step 3: VR A leaves Scene 1 without being deactivated.	Primary (in transit)	N/A
Step 4: VR A arrives at Scene 2 where VR B is also Primary. * Either VR A or VR B could become Primary	Primary* (Scene 2)	Secondary (Scene 2)

[1] www.futurecom.com->Support Portal->Documentation and Software->DVR-LX/DVR/VRX1000->VR Functional Description

Scenario 5: Permanent Primary VR Arrives at Scene with a Primary VR

Permanent Primary Control Configuration: VR A = No, PPVR B = N/A
Permanent Primary Status Configuration: VR A = No, PPVR B = Yes

VR A is Primary at a scene. PPVR B arrives, activates, becomes Permanent Primary and takes over communication at the scene. VR A becomes Secondary.

SCENARIO 5: PERMANENT PRIMARY VR ARRIVES AT SCENE WITH A PRIMARY VR	RESULTING STATUS OF VR	
	VR A	**PPVR B**
Step 1: VR A activates at a scene.	Primary	N/A
Step 2: PPVR B arrives and activates at the scene.	Secondary	Permanent Primary

Additional Operational Scenarios

There are additional features that have an impact on the Primary/Secondary feature: Call Alert, Emergency Calls, GPS Driven Deactivation and Permanent Primary. For more information on each of these features, refer to the VR Functional Description document.[2] For details on the additional Primary/Secondary scenarios, refer to the Appendices at the end of this document.

[2] www.futurecom.com->Support Portal->Documentation and Software->DVR-LX/DVR/VRX1000->VR Functional Description

Primary/Secondary Operational Area

Primary/Secondary Parameters

A VR can be configured to use the Primary/Secondary feature efficiently by optimizing several configurable parameters. The value for each parameter will depend on the operational needs of a particular agency. The following parameters impact the range of the Primary/Secondary operational area:

- Busy Lockout Threshold ***(Busy Lc. Th.)***: set higher value to reduce area of operation
- Rx. RSSI Threshold ***(Rx RSSI Thr.)***: set higher value to reduce area of operation
- Tx. RSSI Threshold ***(Tx RSSI Thr.)***: set lower value to increase Multiple Primary VR separation
- Rev. Tx. Power ***(R-TxPwr)***: set higher value to create Multiple Primary VR separation
- Tx Power ***(Tx Pwr.)***: set higher value to increase area of operation

These parameters are found in the FRC Repeater Channel Setup menu and are set per channel.

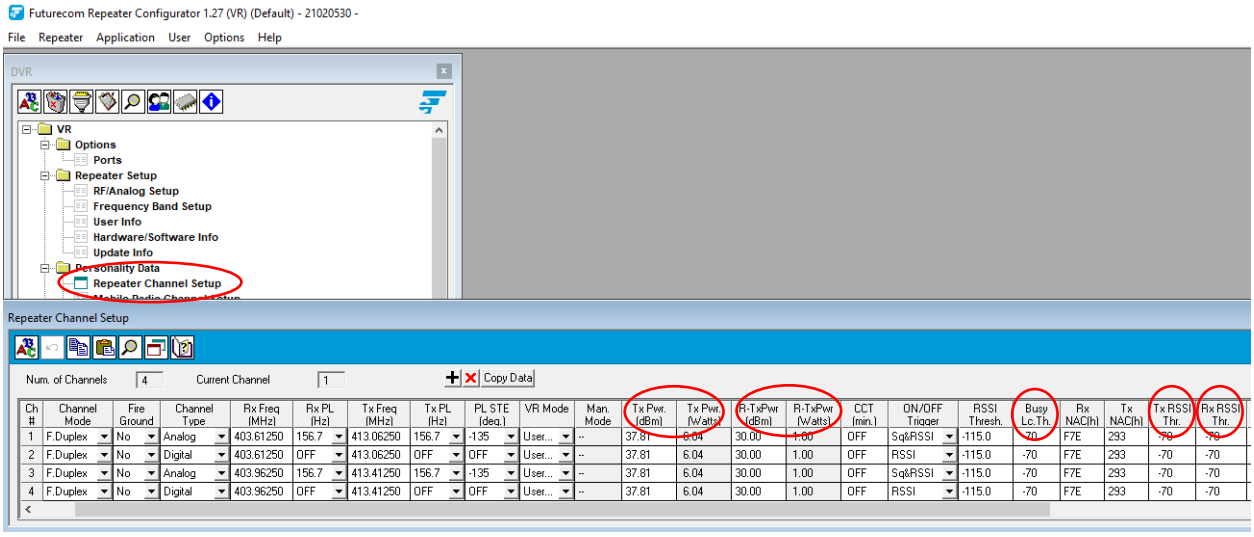

Figure 1: FRC Primary/Secondary Parameters

There is an additional PSU parameter that needs to be considered: PSU Tx Power (***Transmit Power Levels***): set higher value to increase area of operation. This field is found in CPS.

When separate, multiple scenes require use of a VR, communication can be supported by a single Primary VR that has coverage over all scenes. However, where scenes are more remote, each scene would be better served by each having its own Primary VR. The decision point for single versus multiple Primary VRs is determined by the VR coverage range. A greater range permits a Primary VR to support a wide area, while a shorter range enables Primary VR units to operate when their scenes are closer together. This range required is determined by the specific operational needs of the agency and how operations are deployed, such as single, large-area scenes, or multiple, smaller scenes each covering smaller areas.

Maximum Range of a Primary VR: Typical Use Case–Fireground

When the range of a Primary VR is maximized, any VRs detecting the primary heart beat will become Secondary VRs. (see Figure 2) In this scenario, VR A, VR B and VR C are all able to detect each other. The Primary/Secondary feature has selected VR A to become Primary and VR B and VR C become Secondary. The parameter values required to achieve a maximum range or operational area are captured

in Table 1. Note that although Threshold values can be set to these very sensitive levels, this makes the VR system prone to on-channel interference, external RF noise and any shared-channel operations, that could interfere with proper operation. Settings chosen should take into account local radio interference conditions to ensure reliable operation if maximum range is desired.

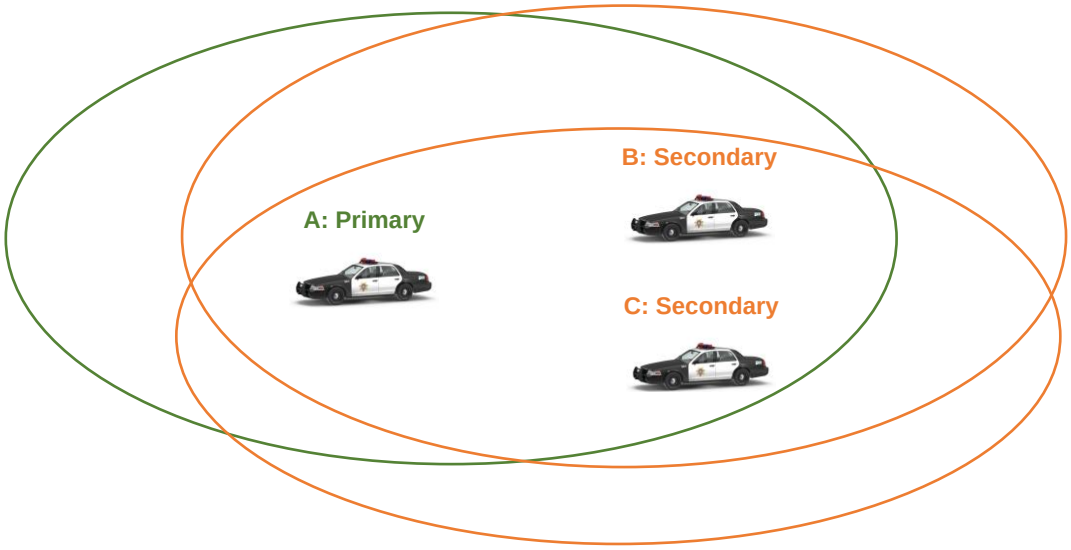

Figure 2: Maximum Operational Area

Parameter	Value for Maximum Range
Busy Lockout Threshold ***(Busy Lc. Th.)***	-105 dBm (lowest value)
Rx. RSSI Threshold ***(Rx RSSI Thr.)***	-110 dBm (lowest value)
Tx. RSSI Threshold ***(Tx RSSI Thr.***)	-110 dBm (lowest value)
Rev. Tx. Power ***(R-TxPwr)***	+40 dBm (highest value)
Tx Power (Tx Pwr.)	highest value allowed per band
PSU Tx Power (Transmit Power Levels)	highest value allowed per band

Table 1: Maximum Range Parameter Values

Minimum Range of a Primary VR: Typical Use Case—State/Provincial Police

Where smaller VR operational areas are a better fit for an agency, the VR range should be reduced. This permits the setup and operation of multiple VR scenes, each with its own Primary VR, with closer separation. This is ideal for operations where the Portable radio remains close to the VR and there is a high likelihood of other independent operations taking place nearby.

When the range of a Primary VR is minimized, any VRs within that minimum operational area will become Secondary VRs (see Figure 3). In this scenario, the VRs are all located in the same position as in Figure 2. However, due to the minimized range, VR A does not detect VR B or VR C and so becomes Primary. VR B and VR C are able to detect each other and the Primary/Secondary feature has selected VR B to become Primary and VR C becomes Secondary. The parameter values required to achieve a minimum range or operational area are captured in Table 2.

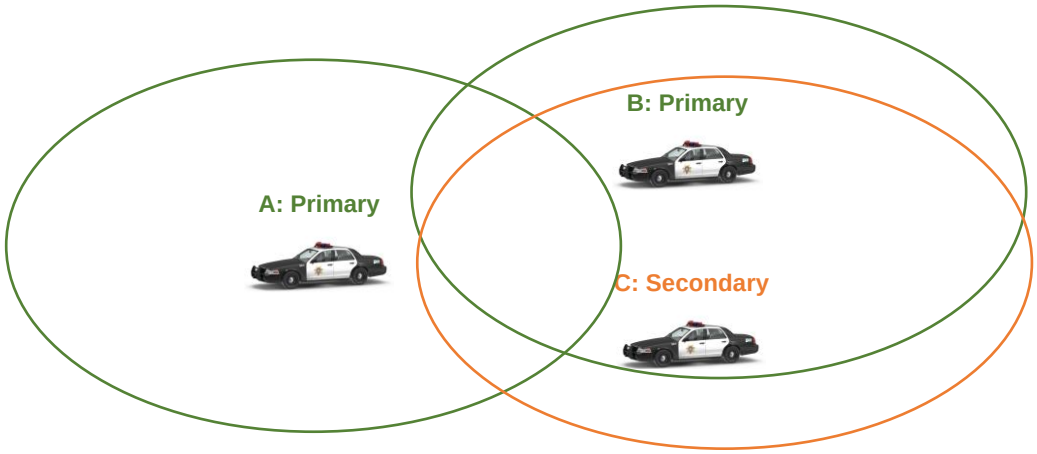

Figure 3: Minimum Operational Area

Parameter	Value for Maximum Range
Busy Lockout Threshold ***(Busy Lc. Th.)***	-65 dBm (highest value)
Rx. RSSI Threshold ***(Rx RSSI Thr.)***	-60 dBm (highest value)
Tx. RSSI Threshold ***(Tx RSSI Thr.***)	-60 dBm (highest value)
Rev. Tx. Power ***(R-TxPwr)***	+20 dBm (lowest value)
Tx Power (Tx Pwr.)	lowest value allowed per band
PSU Tx Power (Transmit Power Levels)	lowest value allowed per band

Table 2: Minimum Range Parameter Values

Please refer to the VR Functional Description document[3] for further details regarding the Primary/Secondary feature.

[3] www.futurecom.com->Support Portal->Documentation and Software->DVR-LX/DVR/VRX1000->VR Functional Description

APPENDIX A: Permanent Primary Operational Scenarios

Scenario A1: User Initiation of Permanent Primary

Permanent Primary Control Configuration: VR A = Yes, VR B = Yes
Permanent Primary Status Configuration: VR A = No, VR B = No

VR A and VR B arrive at a scene. VR A becomes Primary while VR B becomes Secondary.

NOTE: Either VR could become Primary in this scenario—the Primary/Secondary feature determines which one.

VR B wants to take over communication at the scene and the control head is used to promote the VR to Permanent Primary. VR B becomes Permanent Primary and VR A becomes Secondary.

NOTE: While both VRs are configured for Permanent Primary Control, because Permanent Primary Status is set to No, the VRs initially activate as Primary rather than Permanent Primary. The user must make the VR become Permanent Primary via the control head.

SCENARIO A1: USER INITIATION OF PERMENANT PRIMARY	RESULTING STATUS OF VR	
	VR A	VR B
Step 1: VR A and VR B are activated at a scene. *Either VR could become Primary	Primary*	Secondary
Step 2: User promotes VR B to Permanent Primary.	Secondary	Permanent Primary

Scenario A2: Permanent Primary VRs Arrive and Leave Scene Involving Multiple VRs

Permanent Primary Control Configuration: VR A = No, VR B = No, PPVR C= Yes, PPVR D= Yes
Permanent Primary Status Configuration: VR A = No, VR B = No, PPVR C= Yes, PPVR D= Yes

There are two VRs at a scene—VR A is Primary and VR B is Secondary. A third VR, programmed for Permanent Primary (PPVR C), arrives on scene and activates. PPVR C becomes Permanent Primary and takes over communication at the scene. VR A and VR B are now both Secondary.

A fourth VR, also programmed for Permanent Primary (PPVR D), arrives on the scene and activates. PPVR D becomes the Permanent Primary and takes over communication at the scene. VR A and VR B remain as Secondary and PPVR C becomes a standby Permanent Primary.

NOTE: When multiple Permanent Primary VRs arrive at a scene, the last to be activated and put in Permanent Primary mode will become Primary.

PPVR D deactivates and leaves the scene. The standby Permanent Primary, PPVR C, becomes Permanent Primary again and takes over communication at the scene. VR A and VR B remain Secondary.

NOTE: If PPVR D leaves the scene without being deactivated first, the result would be the same but would take longer.

PPVR C is deactivated and leaves the scene. VR A and VR B detect there is no longer a Permanent Primary on scene and they negotiate for one unit to become Primary and one to remain as Secondary.

NOTE: Either VR A or VR B could become Primary—the Primary/Secondary feature determines which one.

SCENARIO A2: PERMANENT PRIMARY VRs ARRIVE AND LEAVE SCENE INVOLVING MULTIPLE VRs	**RESULTING STATUS OF VR**			
	VR A	**VR B**	**PPVR C**	**PPVR D**
Step 1: VR A arrives first at a scene and is activated.	Primary	N/A	N/A	N/A
Step 2: VR B arrives next at the scene and is activated.	Primary	Secondary	N/A	N/A
Step 3: VR C configured for Permanent Primary (PPVR C) arrives at the scene, is activated and becomes Permanent Primary.	Secondary	Secondary	Permanent Primary	N/A
Step 4: VR D configured for Permanent Primary (PPDVR D) arrives at the scene, is activated and becomes Permanent Primary.	Secondary	Secondary	Standby Permanent Primary	Permanent Primary
Step 5: PPVR D is deactivated and leaves the scene.	Secondary	Secondary	Permanent Primary	N/A
Step 6: PPVR C is deactivated and leaves the scene. *Either VR A or VR B could win to become Primary	Primary*	Secondary	N/A	N/A

APPENDIX B: Manual Activation Operational Scenarios

In this set of scenarios, the following terms will be used:

Local Call Alert

- originates from a portable radio
- sent directly to a VR

System Call Alert

- originates from a portable radio or a mobile radio or a console
- sent through the System to the MSU connected to a VR

Scenario B1: Local/System Call Alert to VR With No Other VRs Present

Permanent Primary Control Configuration: N/A
Permanent Primary Status Configuration: VR A = Yes/No

A VR is at a scene but has not been activated. A Call Alert is sent to the VR to activate and begin handling calls at the scene.

SCENARIO B1: LOCAL/SYSTEM CALL ALERT TO VR WITH NO OTHER VRs PRESENT	RESULTING STATUS OF VR
	VR A
Step 1: VR A is at a scene but has not been activated.	Off
Step 2: Call Alert is sent to VR A.	Permanent Primary or Primary (based on Status configuration)

Scenario B2: Local Call Alert to VR With Primary On Scene

Permanent Primary Control Configuration: N/A
Permanent Primary Status Configuration: VR A = No, VR B = Yes/No

Two VRs are at a scene with VR A being Primary and VR B is Secondary/Off. A local PSU sends a Call Alert to VR B as the user wants to make a call to the System but is out of range of the Primary VR A. VR B receives the Call Alert, becomes the Primary and handles the call from the local PSU while the original Primary VR A becomes Secondary.

SCENARIO B2: LOCAL CALL ALERT TO VR WITH PRIMARY ON SCENE	RESULTING STATUS OF VR	
	VR A	VR B
Step 1: VR A and VR B are at a scene.	Primary	Secondary/Off
Step 2: Local PSU sends a Call Alert to VR B	Secondary	Permanent Primary or Primary (based on Status configuration)

Scenario B3: System Call Alert to VR With Primary On Scene

Permanent Primary Control Configuration: N/A
Permanent Primary Status Configuration: VR A = No, VR B = No

Two VRs are at the same scene with VR A being Primary and VR B as Secondary/Off. A System Call Alert is sent to MSU connected to VR B. VR B receives the Call Alert, activates if it was Off, but will remain as Secondary while the original Primary VR A remains Primary.

SCENARIO B3: SYSTEM CALL ALERT TO VR WITH PRIMARY ON SCENE	RESULTING STATUS OF VR	
	VR A	VR B
Step 1: VR A and VR B are at a scene.	Primary	Secondary/Off
Step 2: System Call Alert sent to MSU connected to VR B.	Primary	Secondary

Permanent Primary Control Configuration: N/A
Permanent Primary Status Configuration: VR A = No, PPVR B = Yes

Two VRs are at the same scene with VR A being Primary and VR B as Off. A System Call Alert is sent to MSU connected to VR B. VR B receives the Call Alert, becomes Permanent Primary and handles calls at the scene while the original Primary VR A becomes Secondary.

SCENARIO B3: SYSTEM CALL ALERT TO VR WITH PRIMARY ON SCENE—WHERE TARGET VR IS PROGRAMMED FOR PERMANENT PRIMARY	RESULTING STATUS OF VR	
	VR A	PPVR B
Step 1: VR A and PPVR B are at a scene.	Primary	Off
Step 2: System Call Alert sent to MSU connected to VR B	Secondary	Permanent Primary

Scenario B4: Local/System Call Alert to VR with Permanent Primary On Scene

Permanent Primary Control Configuration: N/A
Permanent Primary Status Configuration: VR A = Yes, VR B = No

Two VRs are at the same scene where VR A is Permanent Primary and VR B is Secondary/Off. A Call Alert from any source is sent to VR B. VR B receives the Call Alert, activates if it was Off, but will remain as Secondary and the Permanent Primary VR A continues to handle calls at the scene.

NOTE: The Local Call Alert is sent directly to VR, while System Call Alert sent to MSU connected to VR.

SCENARIO B4: LOCAL/SYSTEM CALL ALERT TO VR WITH PERMANENT PRIMARY ON SCENE	RESULTING STATUS OF VR	
	VR A	VR B
Step 1: VR A and VR B are at a scene.	Permanent Primary	Secondary/Off
Step 2: Local/System* Call Alert sent to VR B *System Call Alert->MSU->VR B	Permanent Primary	Secondary

Scenario B5: Emergency Call with No Active VRs

Permanent Primary Control Configuration: N/A
Permanent Primary Status Configuration: VR A = No, VR B = No, VR C= No

Multiple VRs are at a scene but have not been activated—they are all Off. A local PSU initiates an Emergency call. All the VRs receive the Emergency Call, determine there is no Primary unit and negotiate which unit will become Primary to start handling the call while the other two will become Secondary.

NOTE: Any of the VRs can become Primary—the Primary/Secondary feature determines which one.

SCENARIO B5: EMERGENCY CALL WITH NO ACTIVE VRs	RESULTING STATUS OF VR		
	VR A	VR B	VR C
Step 1: VR A, VR B and VR C are all at the same scene but are not activated.	Off	Off	Off
Step 2: Local PSU initiates an Emergency call. *Any of the VRs could win to become Primary	Secondary	Primary*	Secondary

Scenario B6: Emergency Call with No Active VRs but one is PP

Permanent Primary Control Configuration: N/A
Permanent Primary Status Configuration: VR A = No, VR B = No, PPVR C = Yes

Multiple VRs are at a scene but have not been activated—they are all Off. A local PSU initiates an Emergency call. All the VRs receive the Emergency Call, determine there is no Primary unit and negotiate which unit will become Primary to start handling the call. One of the VRs has been configured as a Permanent Primary, so this VR will become Permanent Primary while the other two will become Secondary.

SCENARIO B6: EMERGENCY CALL WITH NO ACTIVE VRs	RESULTING STATUS OF VR		
	VR A	VR B	PPVR C
Step 1: VR A, VR B and PPVR C are all at the same scene but are not activated.	Off	Off	Off
Step 2: Local PSU initiates an Emergency call.	Secondary	Secondary	Permanent Primary

Scenario B7: Emergency Call Detected by Secondary VR Only

Multiple VRs are at a scene where one is Primary and the others are Secondary. A local PSU initiates an Emergency call that is detected only by one of the Secondary units as the PSU is out of range of the other VRs. The Secondary unit that received the Emergency call handles the call and becomes the new Primary while the other units are now all Secondary.

SCENARIO B7: EMERGENCY CALL DETECTED BY SECONDARY VR ONLY	RESULTING STATUS OF VR		
	VR A	VR B	VR C
Step 1: VR A, VR B and VR C are all activated in the same scene. *Any VR could become Primary.	Primary*	Secondary	Secondary
Step 2: Local PSU initiates an Emergency call that is detected only by Secondary VR B.	Secondary	Primary	Secondary

APPENDIX C: GPS Driven Deactivation Operational Scenarios

The Primary/Secondary feature is typically intended for operation at stationary scenes only. The basic operational scenarios and the alternate scenarios described in Appendix A and B apply to stationary VRs only. The GPS Driven Deactivation feature introduces scenarios where a VR can be moving while activated. The following set of scenarios are applicable when the GPS Driven Deactivation Feature is enabled. For more information on how this feature works, refer to the VR Functional Description[4] and for information on how to program this feature, refer to the VR Programming Guide[5].

Scenario C1: Moving Primary Within and Out of GPS Threshold

There are multiple stationary VRs at a scene—one VR is Primary while the others are all Secondary. The Primary VR needs to relocate at the scene and the vehicle is driven to a new location and parked while remaining within the preconfigured GPS threshold. The Primary VR continues to handle communications at the scene and the other VRs remain as Secondary.

The Primary VR needs to relocate again at the scene but this time, it goes beyond the preconfigured GPS threshold. The Primary VR deactivates and is Off while the remaining Secondary units negotiate for one unit to become Primary and the others to remain as Secondary.

SCENARIO C1: MOVING PRIMARY WITHIN AND OUT OF GPS BOUNDARY	**RESULTING STATUS OF VR**		
	VR A	**VR B**	**VR C**
Step 1: VR A, VR B and VR C are at a scene and are activated. *Any of the VRs could win to become Primary	Primary*	Secondary	Secondary
Step 2: VR A relocates to a new position within GPS threshold.	Primary	Secondary	Secondary
Step 3: Primary VR A relocates and exceeds the GPS threshold. *Either VR B or VR C could win to become Primary	Off	Primary*	Secondary

[4] www.futurecom.com->Support Portal->Documentation and Software->DVR-LX/DVR/VRX1000->VR Functional Description
[5] www.futurecom.com->Support Portal->Documentation and Software->DVR-LX/DVR/VRX1000->VR Programming Guide

Scenario C2: Moving Primary within GPS Threshold Encounters Stationary Primary

Primary/Secondary Preference Configuration: All VRs = Stationary

There are multiple stationary VRs at scene 1—one VR is Primary while the others are all Secondary. The Primary VR starts driving away from the scene. While it is still within the preconfigured GPS threshold, the moving Primary VR comes in range of a stationary Primary VR at scene 2. The two VRs negotiate and the stationary VR remains as Primary at scene 2 while the moving Primary VR becomes Secondary. The Secondary units at scene 1 negotiate for one to become Primary and the others to remain Secondary. The moving Secondary VR continues driving, moves outside of the preconfigured GPS threshold and is now Off.

SCENARIO C2: MOVING PRIMARY WITHIN GPS THRESHOLD ENCOUNTERS STATIONARY PRIMARY	**RESULTING STATUS OF VR**			
	SCENE 1			**SCENE 2**
	VR A	**VR B**	**VR C**	**VR D**
Step 1: VR A, VR B and VR C are at a scene and are activated. *Either VR A, VR B or VR C could win to become Primary	Secondary	Secondary	Primary*	N/A
Step 2: Primary VR C moving within GPS threshold comes in range of stationary Primary VR D. *Either VR A or VR B could win to become Primary. **Stationary VR D will always win over moving VR C	Primary*	Secondary	Secondary (moving in range of scene 2)	Primary**
Step 3: Secondary VR C continues moving and exceeds the GPS threshold.	Primary	Secondary	Off	Primary

If Primary/Secondary Preference feature has been set to give preference to Stationary VRs, then the following chart illustrates the relative priority of each type of unit. If two active VRs come in range of each other, the VR that has the highest priority as per the chart below will become the Primary and the other unit(s) will become Secondary.

Permanent Primary – Stationary
Permanent Primary – In motion
Primary – Stationary
Primary – In motion
Secondary

Figure 2: Relative Priority for Active VR Negotiation

Scenario C3: Local/System Call Alert to Moving VR in Range of Stationary VR

Primary/Secondary Preference Configuration: All VRs = Stationary
Permanent Primary Status Configuration: VR A = VR B (both Yes/No)

NOTE: This scenario is the same whether the VRs are configured as both Permanent Primary or not Permanent Primary. The following description will refer to Primary but is applicable to Permanent Primary as well.

VR A is Primary and stationary at a scene. VR B is Secondary/Off, is in motion and is within range of VR A.

A Call Alert from any source is sent to VR B. VR B receives the Call Alert, activates if it was Off, but will remain as Secondary and the Primary VR A continues to handle calls at the scene.

NOTE: The Local Call Alert sent directly to VR, while System Call Alert sent to MSU connected to VR.

SCENARIO C3: LOCAL/SYSTEM CALL ALERT TO MOVING VR IN RANGE OF STATIONARY	**RESULTING STATUS OF VR (when neither VR configured PP)**	
	VR A	**VR B**
Step 1: VR A is stationary and VR B is in motion.	Primary	Secondary/Off
Step 2: Local/System* Call Alert sent to VR B *System Call Alert->MSU->VR B	Primary	Secondary
SCENARIO C3: LOCAL/SYSTEM CALL ALERT TO MOVING VR IN RANGE OF STATIONARY	**RESULTING STATUS OF VR (when both VR configured PP)**	
	PPVR A	**PPVR B**
Step 1: VR A is stationary and VR B is in motion.	Permanent Primary	Standby Permanent Primary/Off
Step 2: Local/System* Call Alert sent to VR B *System Call Alert->MSU->VR B	Permanent Primary	Standby Permanent Primary

APPENDIX D: Common Primary/Secondary Questions

QUESTION: Why are two VRs within range of each other both acting as Primary units?

ANSWER: There are a number of reasons why this could occur. If the installation (check antenna connections) and configuration have been verified, then likely the VRs are operating on different channels. (see Scenarios D1, D2)

Scenario D1: Multiple VRs at a Scene Activate on Different Channels

Two different agencies arrive at a scene. Their VRs are operating on different channels—Agency A on ChA and Agency B on ChB. The VRs are both activated, and both become Primary units. VR A will handle all calls on ChA while VR B will handle all calls on ChB.

SCENARIO C1: MULTIPLE VRs AT A SCENE ACTIVATE ON DIFFERENT CHANNELS	RESULTING STATUS OF VR	
	VR A	VR B
Step 1: VR A, VR B arrive at a scene and are activated on ChA and ChB.	Primary (ChA)	Primary (ChB)

Scenario D2: Multiple Primary VRs at a Scene Changing Channels

Three VRs arrive at a scene and are activated on the same channel. The VRs negotiate and one VR becomes Primary while the other two units become Secondary.

NOTE: Any of the VRs could become Primary in this scenario.

One of the Secondary VRs is changed to a new channel. As the current Primary VR is on a different channel, this Secondary VR becomes Primary on the new channel. The third VR remains a Secondary unit.

The Primary VR on the new channel is changed back to the original channel and as there is already a Primary unit, it will become Secondary again.

SCENARIO C2: MULTIPLE PRIMARY VRs AT A SCENE ON DIFFERENT CHANNELS	RESULTING STATUS OF VR		
	VR A	VR B	VR C
Step 1: VR A, VR B and VR C arrive at a scene and are activated on Channel1 (Ch1). * Any of the VRs could win to become Primary	Primary (Ch1)*	Secondary (Ch1)	Secondary (Ch1)
Step 2: VR B is changed to Channel2 (Ch2).	Primary (Ch1)	Primary (Ch2)	Secondary (Ch1)
Step 3: VR B is changed back to Ch1.	Primary (Ch1)	Secondary (Ch1)	Secondary (Ch1)

QUESTION: What does the “Allow Secondary DVR to take over OOR Primary” field in the Primary/Secondary Setup FRC window do?

ANSWER: When a VR arrives on a scene where the Primary and Secondary VRs are out of range of the system, the new VR will take over as Primary if it is within range of the system.

This also applies to a VR arriving on a scene where the Primary VR is from a foreign system. If the new VR is on its home system, it will be given higher priority and will take over communications at the scene as the new Primary VR.

QUESTION: How to I use the Control Head to put a VR into Permanent Primary?

ANSWER: There are two options that can be configured in FRC to give the user the ability to put a VR into Permanent Primary via the control head. Please refer to the VR Programming Guide[6] for further information on how to program.

1. DVRS button-> long press
2. DVRS button-> PM button

QUESTION: Why is Permanent Primary VRA in standby mode when in range of a Primary VRB?

ANSWER: There is another active PP VRC in range of the standby PPVRA which is causing PPVRA to remain in standby mode. Primary VRB is out of range of PP VRC.

[6] www.futurecom.com->Support Portal->Documentation and Software->DVR-LX/DVR/VRX1000->VR Programming Guide

Glossary

Keyword	Description
Busy Lockout	Dynamic voting phase (follows the static Primary / Secondary phase) of the VR simulcast prevention algorithm.
Channel	A group of characteristics, such as transmit / receive frequency pairs, radio parameters, encryption encoding etc.
Conventional	Refers to radio-to-radio communications, sometimes through a base station repeater or vehicular repeater.
DVR	Digital Vehicular Repeater.
DVRS	When a Vehicular Repeater (VR) is interfaced with an MSU, the complete equipment package is referred to as a Digital Vehicular Repeater System (DVRS).
'DVRS Enabled' PSU	APX™ Portable Radio with enabled DVRS operation.
FRC	Futurecom Repeater Configurator: VR programming software application. Replacement for the Tweaker programming software application.
Heart Beat	P25 Message periodically sent by a Primary VR to other VRs during Primary / Secondary processing.
Local Mode	VR Mode which provides extended portable-to-portable voice and data range by repeating Local PSU (optionally MSU) communications without keying up the Mobile radio interfaced to the VR.
Local PSU	PSU switched to the VR channel and used for communication with the VR
Mode	**MSU / PSU**–A programmed combination of operating parameters. **VR** – OFF, SYSTEM or LOCAL (see **VR Mode**)
MSU	Mobile Subscriber Unit
PSU	Portable Subscriber Unit.

Keyword	Description
RF	Radio Frequency. Part of the general frequency spectrum 10kHz—10,000,000 MHz.
RSSI	Received Signal Strength Indicator.
System Mode	VR mode which provides extended voice and signaling communications between System Users and Local Portable Users over the selected VR channel / Mobile Radio Mode.
Talkgroup	A group of radio users who communicate with each other by using the same communication path.
Talkgroup Translation	Feature where the PSU talkgroup is translated by the VR to match the currently selected MSU talkgroup.
VR	Futurecom line of Vehicular Repeaters. It applies to one of the following products: VRX1000, DVR and DVR-LX®.
VR Mode	Determines the communication exchange capabilities between System Users and Local Portable Users; Can be set to OFF, LOCAL or SYSTEM.