MOTOROLA SOLUTIONS

Vehicular Repeater User Guide

JULY 2024

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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

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Important Safety Information

The DVRS Repeater is intended for use in occupational/controlled conditions, where users have full knowledge of the operator exposure and can exercise control over the operator exposure to meet FCC/ISED limits. This radio is NOT authorized for general population, consumer, or any other use.

Informations de Sécurité Importantes

Le répéteur DVRS est conçu pour être utilisé dans des conditions professionnelles contrôlées, dans lesquelles les utilisateurs connaissent à fond leur exposition et peuvent exercer le contrôle nécessaire sur celle-ci pour se conformer aux limites de la FCC/ISED. Cette radio N'EST PAS autorisée pour être utilisée par le grand public, les consommateurs ou autres.

Notice to Users (FCC/ISED)

To satisfy FCC/ISED RF exposure requirements for mobile transmitting devices, refer to the RF Safety Booklet[1] for TX – RX duty cycle and a separation distance between the antenna of this device and persons during operation. To ensure compliance, operations at closer than this distance is not allowed.

Motorola Solutions requires the P25 DVRS operator to ensure FCC/ISED Requirements for Radio Frequency Exposure are met. The minimum distance between all possible personnel and the body of the DVRS equipped vehicle is specified in the RF Safety Booklet[1]. Failure to observe the Maximum Permissible Exposure (MPE) distance exclusion area around the antenna may expose persons within this area to RF energy above the FCC exposure limit for bystanders (general population).

[1] Refer to the manuals *Product Safety and RF Energy Exposure Booklet for PDR8000* (publication number MN010431A01) and *Product Safety and RF Energy Exposure Booklet for Booster Pack* (publication number MN010430A01).

It is the responsibility of the repeater operator to ensure that MPR limits are always observed during repeater transmissions. The repeater operator must always ensure that no person comes within MPE distance from the antenna.

Avis Aux Utilisateurs (FCC/ISED)

Pour satisfaire les exigences de la FCC / ISED en matière d'exposition à l'énergie RF pour les transmetteurs mobiles, prière de consulter la Brochure Sécurité RF[1] pour obtenir le facteur d'utilisation transmission / réception et la distance de séparation entre l'antenne de cet appareil et les personnes pendant l'utilisation. Pour assurer la conformité, le fonctionnement à une distance moins élevée n'est pas autorisé.

Motorola Solutions demande à l'opérateur du répéteur P25 DVRS de satisfaire aux exigences de la FCC/ ISED en matière d'exposition à l'énergie RF. La distance minimale entre toutes les personnes possibles et une antenne omnidirectionnelle doit respecter les indications de la Brochure Sécurité RF[1]. Tout manquement à respecter la zone d'exclusion autour de l'antenne définie par la distance correspondant à la limite d'exposition maximale peut exposer les personnes qui se trouvent dans ce rayon à une énergie RF supérieure à la limite d'exposition de la FCC pour les spectateurs (population générale).

C'est à l'opérateur du répéteur qu'il incombe de s'assurer que les limites d'exposition maximales sont respectées en tout temps pendant les transmissions du répéteur. L'opérateur du répéteur doit s'assurer en tout temps que personne ne s'approche de l'antenne à une distance inférieure à celle correspondant à la limite d'exposition minimale.

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- A description of the error

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Document History

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About This Manual

This manual covers the basic operation of the Vehicular Repeater. The Vehicular Repeater (VR) mentioned in this manual applies to any of the following products: VRX1000, DVR, and DVR-LX®.

VRX 1000

DVR

DVR-LX®

Notations Used in This Manual

This guide is designed to give you more visual cues.

The following graphic icons are used throughout the user guide.

DANGER: The signal word DANGER with the associated safety icon implies information that, if disregarded, will result in death or serious injury.

WARNING: The signal word WARNING with the associated safety icon implies information that, if disregarded, could result in death or serious injury, or serious product damage.

CAUTION: The signal word CAUTION with the associated safety icon implies information that, if disregarded, may result in minor or moderate injury, or serious product damage.

CAUTION: The signal word CAUTION without the associated safety icon implies potential damage to non-MSI equipment, software or data, or injury that is not related to the MSI product.

IMPORTANT: IMPORTANT statements contain information that is crucial to the discussion at hand, but is not a CAUTION or WARNING. There is no warning level associated with the IMPORTANT statement.

NOTE: NOTE contains information more important than the surrounding text, such as exceptions or preconditions. They also refer the reader elsewhere for additional information, remind the reader how to complete an action (when it is not part of the current procedure, for instance), or tell the reader where something is on the screen. There is no warning level associated with a notice.

TIP: TIP contains information that provides the reader a different or quicker method in accomplishing the same task. At times, they also give the reader the best way to proceed or handle the task.

The following special notations highlight certain information:

Table 1: Special Notations

Example	Description
Menu key or **PTT** button	Bold words indicate a name of a key, button, soft menu item, or programming menu item.

Example	Description
Ordering Guide	Italic word indicates title of a bibliographic resource.
`Powering Off`	Typewriter words indicate the Human Machine Interface (HMI) strings or messages displayed on your display.
File → Templates (DCD Files) → Load DCD Template	Bold words with the arrow between indicate the navigation structure in the menu items.

Related Publications

User Guides

Part Number	Description
MN010246A01	Vehicular Repeater Functional Description Manual

Installation Guides

Part Number	Description
MN010356A01	DVR-LX Installation Guide
MN010352A01	Suitcase DVRS Installation Guide
MN010355A01	VRX1000 Installation Guide

Programming Guides

Part Number	Description
MN010245A01	Vehicular Repeater Programming Guide

Safety Booklets

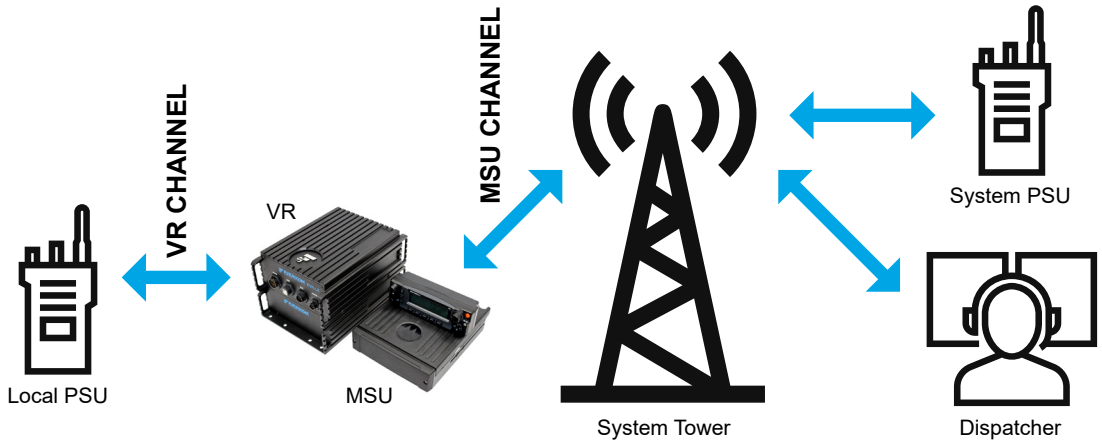
Part Number	Description
MN010428A01	Product Safety and RF Energy Exposure Booklet for Digital Vehicular Repeater Systems (Canada)
MN010429A01	Product Safety and RF Energy Exposure Booklet for Digital Vehicular Repeater Systems (USA)

Chapter 1

System Topology

A system typically involves the following components: Local Portable Subscriber Unit (PSU), Vehicular Repeater (VR), Mobile Subscriber Unit (MSU), System Tower, System PSU, and Dispatcher. Two key communication paths, VR Channel and MSU Channel, are referenced throughout this manual. VR Channel refers to the path between local PSUs and the VRs, while MSU Channel refers to the path between the MSU and the System. Both communication paths and all components are identified in Figure 1: System Topology on page 15.

Figure 1: System Topology



NOTE: For a Trunking System, the communication path between the MSU and the System is referred to as a Talkgroup. Throughout this manual, the Conventional System term, Channel, is used.

Chapter 2

Introduction to Vehicular Repeater

The Vehicular Repeater (VR) is used to extend portable radio communications. When Portable Subscriber Units (PSUs) have difficulty reaching a system tower, a VR can help by linking the PSU to a higher-power mobile radio or Mobile Subscriber Unit (MSU).

Figure 2: Vehicle Mount Scenarios

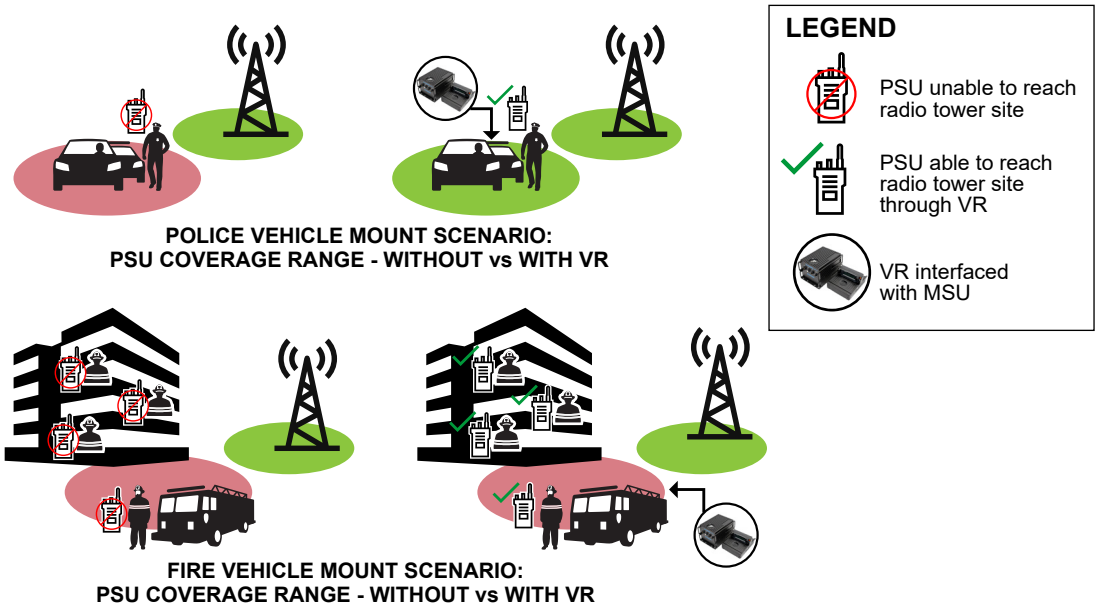
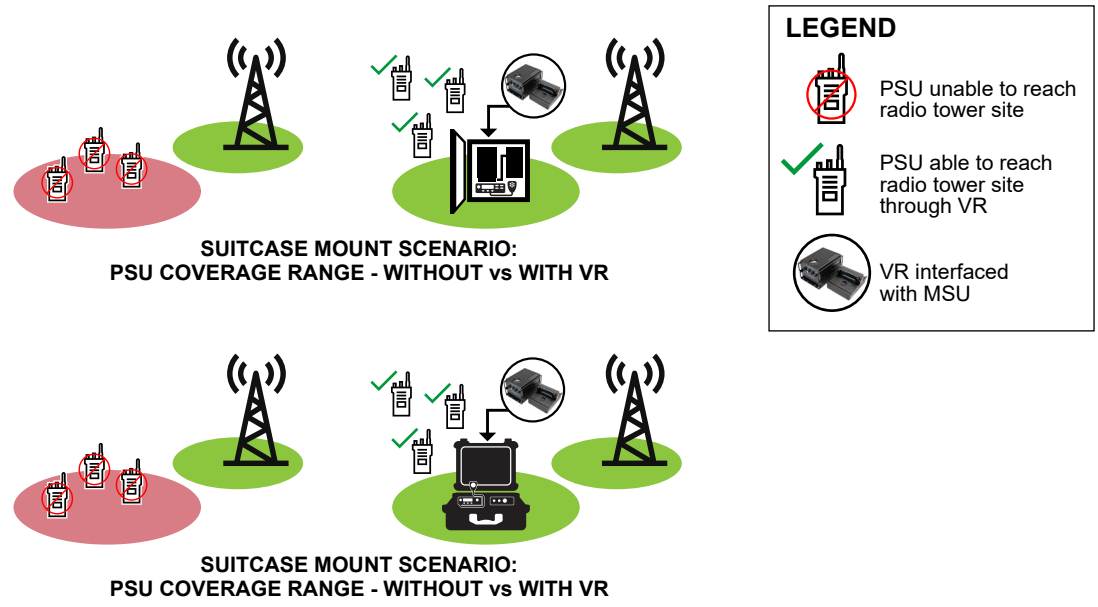


Figure 3: Rackmount and Suitcase Scenarios



Chapter 3

Vehicular Repeater Modes

The mode of the Vehicular Repeater (VR) determines which communication paths are available to the user. Three possible modes are available, which are OFF, LOCAL, and SYSTEM.

NOTE: Available modes depend on configuration. Local mode monitoring depends on configuration as well.

Figure 4: DVR/DVR-LX® Modes

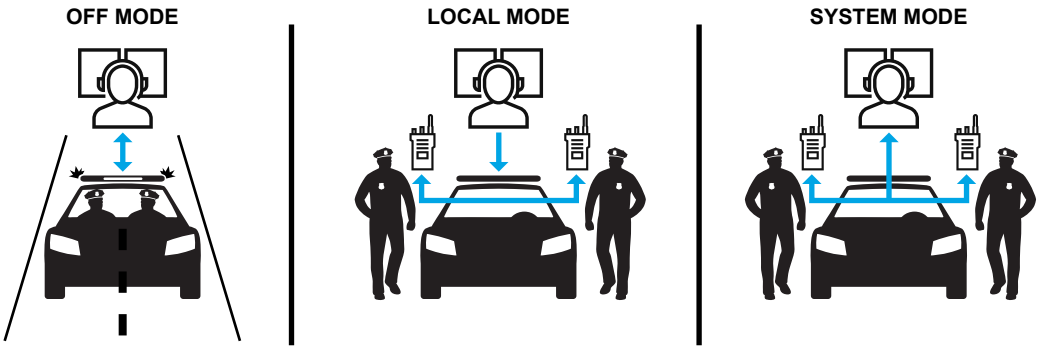
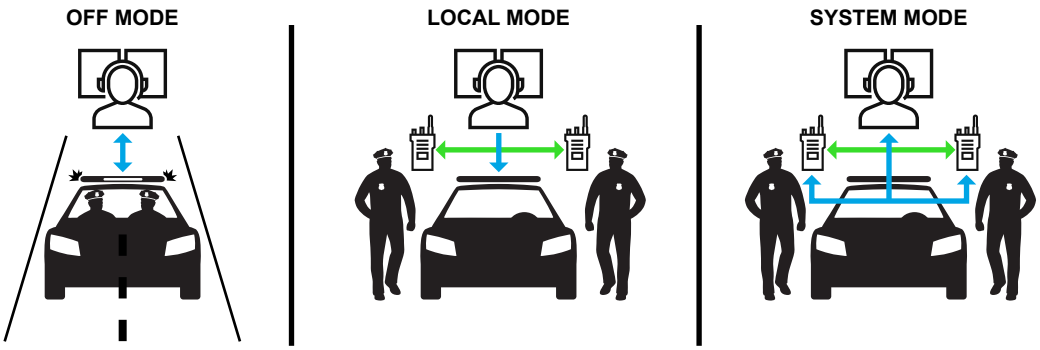


Figure 5: VRX1000 Modes



OFF Mode

Used When

This mode is always used when a vehicle is moving, therefore the VR is off.

Communication Paths

This mode allows the user to communicate with the Dispatcher and System Portable Subscriber Units (PSUs) using Mobile Subscriber Unit (MSU).

LOCAL Mode

Used When

This mode may be used when a vehicle is stationary and the VR is active.

This mode is typically used at a scene outside of network coverage and eliminates the system access deny tones heard on the local PSUs.

This mode is also used when Dispatch does not need to monitor communications. LOCAL mode allows communication at a scene without using system resources, in example, when MSU channels are limited.

Communication Paths

This mode allows communication between the local PSUs and MSU.

With a DVR/DVR-LX, repeated communication is present between local PSUs and MSU.

With a VRX1000, the local PSUs communicate directly with each other and a local PSU communicates with the MSU through the VR.

NOTE: The ability to monitor system activity on the selected MSU channel through the MSU speaker or local PSU is configurable.

SYSTEM Mode

Used When

This mode may be used when a vehicle is stationary and the VR is active.

This mode is used when communication or monitoring by Dispatch at a scene is required.

Communication Paths

This mode allows communication between the local PSUs, MSU, Dispatcher, and System PSUs.

With a DVR/DVR-LX, repeated communication is present between local PSUs and MSU.

With a VRX1000, the local PSUs communicate directly with each other and through the DVRS to communicate with Dispatcher and System PSUs.

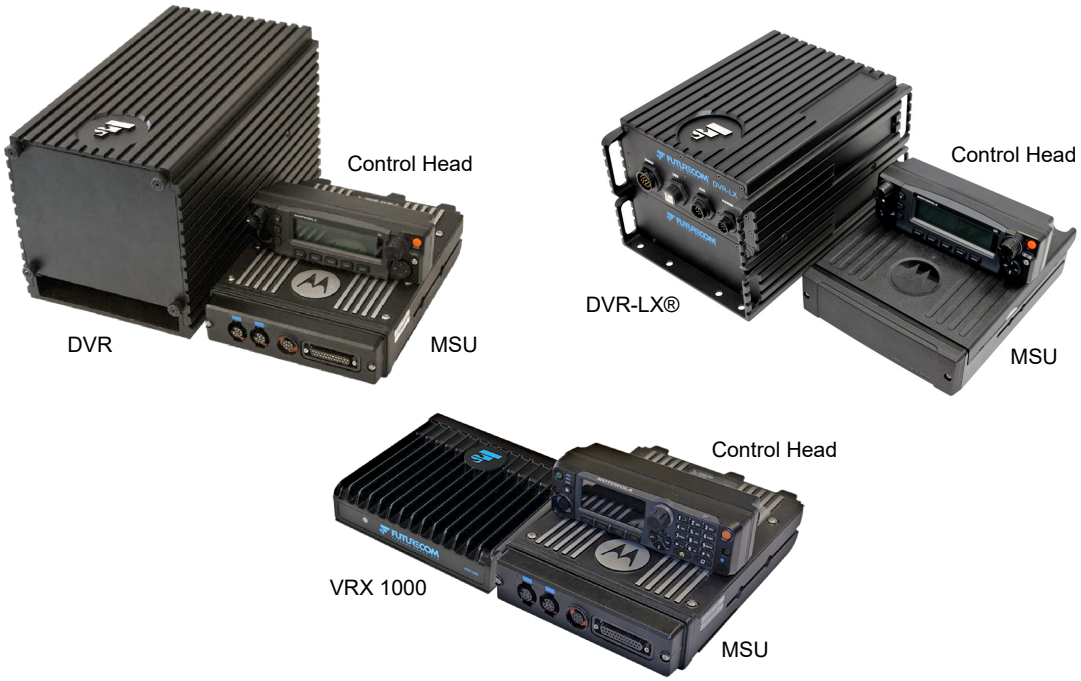
Chapter 4

DVRS Equipment

When a Vehicular Repeater (VR) is interfaced with an Mobile Subscriber Unit (MSU), the complete equipment package is referred to as a Digital Vehicular Repeater System (DVRS). The VR connects directly to the MSU and essentially becomes part of that MSU. The MSU continues to operate while the VR is active. All control of the VR is achieved through the MSU control head and all related messaging is displayed there as well.

Figure 6: DVRS Equipment

DVRS Packages: VR, MSU, Control Head



4.1

DVRS Configurations

Digital Vehicular Repeater System (DVRS) equipment is available in a number of different mounting configurations: rack (DVR-LX® only), suitcase, or vehicle.

Figure 7: DVRS Configurations

From left: Vehicle Mount, Suitcase Mount, and Rackmount

Vehicle Mount

This configuration typically involves installation of the Control Head in the front of the vehicle for user access, while the Vehicular Repeater (VR) and Mobile Subscriber Unit (MSU) are installed in the trunk, back seat, or wherever space allows.

Suitcase Mount

This configuration packages all components of the DVRS in a durable suitcase.

This unit can be deployed where needed and is powered up by plugging into an AC outlet, or into a DC source such as a vehicle or Battery Pack[2] (sold separately).

Rackmount (DVR-LX)

This configuration is permanently installed in an indoor rack. The rack accommodates all components of the DVRS.

[2] Refer to the manual *Suitcase DVRS Installation Guide*.

Chapter 5

Vehicular Repeater Operation

This section describes the operations of your Vehicular Repeater (VR).

5.1 Powering Up the VR

Procedure:

To power up the Vehicular Repeater (VR), turn on the Mobile Subscriber Unit (MSU) control head.

TIP: The VR mode and VR channel that the VR powers up on is configurable.

Result: The VR powers up together with the MSU.

NOTE: There is no independent power ON/OFF for a VR. The VR always powers up together with MSU.

5.2 Activating the VR

The Vehicular Repeater (VR) must be activated to communicate with the Dispatcher, System Portable Subscriber Units (PSUs), or other local PSUs.

Procedure:

Use one of the following options:

Option	Action
The MSU is powered up and is on a VR Disabled MSU channel.	Select a VR Enabled Mobile Subscriber Unit (MSU) channel to activate the VR. **NOTE:** The availability of VR Disabled channels is configurable.

Option	Action
The VR is OFF.	Activate the VR using one of the following methods: • Activating the VR Using MSU Control Head Single Button Press on page 22 • Activating the VR Using MSU Control Head Menu on page 22 • VR Activation Using AVRA on page 23 **NOTE:** This method does not require user-interaction. • VR Remote Activation from Local PSU on page 23 **NOTE:** This method does not require user-interaction. • VR Remote Activation from System User on page 23 **NOTE:** This method does not require user-interaction.

5.2.1
Activating the VR Using MSU Control Head Single Button Press

TIP: A button press can be configured as either a short or long button press.

Procedure:

1. Ensure that the Mobile Subscriber Unit (MSU) is powered up and a Vehicular Repeater (VR) Enabled MSU channel is selected on the Control Head.
2. Press the **DVRS** (Digital Vehicular Repeater System) button.

5.2.2
Activating the VR Using MSU Control Head Menu

Procedure:

1. Ensure that the Mobile Subscriber Unit (MSU) is powered up and a Vehicular Repeater (VR) Enabled MSU channel is selected on the Control Head.
2. To access menu items, press the **DVRS** (Digital Vehicular Repeater System) button.
3. Perform one of the following actions:
   - Press **MODE** button to move through the available VR modes until the desired mode is displayed.
   - Use the **UP** and **DOWN** buttons on Control Head to move through the available VR modes until the desired mode is highlighted.

   NOTE: Navigation details depend on the Control Head.
4. To confirm selection, press the **SEL** button, or wait until the DVRS menu screen timed-out and the last selected mode is saved.

5.2.3
VR Activation Using AVRA

NOTE: Applicable only if configured. The specific set of actions may vary. Refer to the manual *Vehicular Repeater Programming Guide* for details on installing Automatic Vehicular Repeater Activation (AVRA).

If configured, the Vehicular Repeater (VR) is activated by a predetermined set of actions, such as putting the vehicle into park and opening the driver's side of the door.

NOTE: The user still has the option of manually activating the VR from the Mobile Subscriber Unit (MSU) Control Head or using the Portable Subscriber Unit (PSU) remotely.

5.2.4
VR Remote Activation from Local PSU

The Vehicular Repeater (VR) remotely activates from the local Portable Subscriber Unit (PSU) through one of the following actions:

- Sending a Call Alert Page using the ID of the specific VR.
- Initiating an Emergency Alarm.
- Entering a predefined Touch-Tone sequence.

  NOTE: Applicable for Analog PSUs only.

5.2.5
VR Remote Activation from System User

The Dispatcher or System Portable Subscriber Unit (PSU) can send a Call Alert Page to a specific Mobile Subscriber Unit (MSU) ID. When a Call Alert Page is sent, the attached Vehicular Repeater (VR) cycles through modes in the following sequence: **OFF** → **SYS** → **LOC** → **OFF**. If enabled, the Dispatcher receives notification of the mode change for the VR as a Status message.

NOTE: The list of available modes depends on configuration. Mode change notification for Dispatcher is also configurable.

5.3
Deactivating the VR

If the Vehicular Repeater (VR) is active (VR SYSTEM MODE or VR LOCAL MODE depending on available modes), it must be deactivated before driving to or away from an incident.

Procedure:

Deactivate the VR using one of the following methods:

- Deactivating the VR Using MSU Control Head Single Button Press on page 24
- Deactivating the VR Using MSU Control Head Menu on page 24
- Deactivating the VR Using MSU Channel Selection on the Control Head on page 24
- VR Automatic Deactivation on page 24

  NOTE: This method does not require user-interaction.

- VR Remote Deactivation from System User on page 25

  NOTE: This method does not require user-interaction.

5.3.1
Deactivating the VR Using MSU Control Head Single Button Press

TIP: A button press can be configured as either a short or long button press.

Procedure:

Press the **DVRS** (Digital Vehicular Repeater System) button.

5.3.2
Deactivating the VR Using MSU Control Head Menu

Procedure:

1. To access menu items, press the **DVRS** (Digital Vehicular Repeater System) button.
2. Perform one of the following actions:
   - Press **MODE** button until `VR OFF` mode is displayed.
   - Use the **UP** and **DOWN** buttons on Control Head to move through the available Vehicular Repeater (VR) channels until the desired VR channel is highlighted.

     NOTE: Navigation details depend on the Control Head.
3. To confirm selection, press the **SEL** button, or wait until the DVRS menu screen timed-out and the last selected mode is saved.

5.3.3
Deactivating the VR Using MSU Channel Selection on the Control Head

NOTE: Applicable only if Vehicular Repeater (VR) Disabled channels are configured.

Procedure:

Using the Control Head, select a VR Disabled MSU Channel.

TIP: If the Mobile Subscriber Unit (MSU) Channel is VR Disabled, a `VR DISABLED` status message is displayed on the top line of the Control Head and there is no VR status icon visible.

5.3.4
VR Automatic Deactivation

NOTE: Applicable only if configured. The specific set of actions may vary.

If configured, the Vehicular Repeater (VR) automatically deactivates using one of the following methods:

Table 2: VR Automatic Deactivation

Method	Action
AVRA	If enabled, the VR is deactivated by a predetermined action, for example: ● Placing the Portable Subscriber Unit (PSU) back in the charger. ● Shifting the vehicle out of park mode. ● Releasing the air brakes. The user still has the option of manually deactivating VR from the Mobile Subscriber Unit (MSU) Control Head or using the PSU remotely.
Inactivity Timer	If enabled, the VR switches to OFF mode after a preconfigured amount of time.
GPS Driven Deactivation	If enabled, the VR is deactivated by exceeding a preconfigured threshold related to speed and/or distance.

NOTE: For details on these methods, see the manual *Vehicular Repeater Programming Guide*.

5.3.5
VR Remote Deactivation from System User

The Dispatcher or System Portable Subscriber Unit (PSU) can send a Call Alert Page to a specific Mobile Subscriber Unit (MSU) ID. When a Call Alert Page is sent, the attached Vehicular Repeater (VR) cycles through modes in the following sequence: **OFF** → **SYS** → **LOC** → **OFF**. If enabled, the Dispatcher receives notification of the mode change for the VR as a Status message.

NOTE: The list of available modes depends on configuration.

5.4
Powering Down the VR

Procedure:

To power down the Vehicular Repeater (VR), turn off the Mobile Subscriber Unit (MSU) Control Head..

Result: The VR powers down together with the MSU.

NOTE: There is no independent power ON/OFF for a VR. The VR always powers down together with MSU.

5.5
Control Head Menu Navigation

The Mobile Subscriber Unit (MSU) Control Head provides access to the Vehicular Repeater (VR).

The first line of the display contains VR information while the second line of the display contains MSU information. The bottom of the display shows options that are accessed through the corresponding physical buttons.

Figure 8: Control Head Display

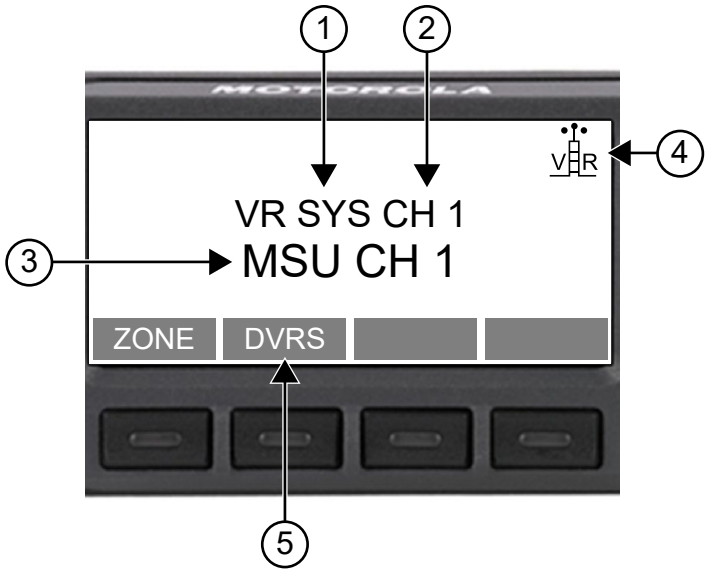


Table 3: Control Head Display

Annotations	Description
1	**VR Mode** The current mode of the VR. The available modes are displayed as follows: • VR OFF (Off or Mobile Mode) • VR SYS (System Mode) • VR LOC (Local Mode) **NOTE:** The list of available modes depends on configuration.
2	**VR Channel** The channel that the VR and the PSU use for communication. The local PSU must be on this channel to communicate through the Digital Vehicular Repeater System (DVRS). **NOTE:** The VR can only be activated when a compatible VR Enabled MSU channel is selected. If a VR Disabled MSU channel is selected, the Control Head displays a `VR DISABLED` status message. The availability of VR Disabled channels is configurable.
3	**MSU Channel** Displays the current channel.
4	**VR Status Icon** Displays the status icon relating to the operation of the VR. See VR Status Icon on page 27.
5	**DVRS Button** The DVRS button provides the ability to change VR Mode and VR Channel, or access to the DVRS Menu. See DVRS Button on page 29.

5.5.1

VR Status Icon

The following tables describe the status icons relating to the Vehicular Repeater (VR) operation.

Primary/Secondary Indicators

NOTE: For more details regarding the Primary/Secondary and Permanent Primary features, refer to the manual *Vehicular Repeater Functional Description*.

Table 4: Primary/Secondary Indicators

Display Icon	VR Status	Description
Steady	Primary (Active)	The VR is responsible for all communications in its coverage area. All other VRs in the coverage area are in Secondary state.
Flashing	Secondary (Standby)	The VR is not responsible for communications. There is a Primary VR already present in the coverage area.
Steady	Active Permanent Primary[3]	The VR is responsible for all communications in its coverage area. All other VRs in the coverage area are in Secondary state. **NOTE:** If there was an existing Primary VR in the coverage area, the Primary VR will lose its Primary status and switches to Secondary state.
Flashing	Standby Permanent Primary[3]	The VR is not responsible for communications. There is an Active Permanent Primary already present in the coverage area. **NOTE:** When the current Active Permanent Primary leaves the coverage area, the Standby Permanent Primary VR will become the new Active Permanent Primary.

Transmit and Receive Indicators

NOTE: The Transmit and/or Receive arrow indicators are overlaid on top of the Primary/Secondary indicators on the Control Head.

Table 5: Transmit and Receive Indicators

Display Icon	VR Status	Description
	VR Receiving	The VR is currently receiving voice or data.
	VR Transmitting	The VR is currently sending voice or data.

[3] Access to Permanent Primary is configurable.

Display Icon	VR Status	Description
	VR Receiving and Transmitting	The VR is currently receiving and sending voice or data.

5.5.2

VR Status Message

The following table describe the status messages relating to the Vehicular Repeater (VR) operation.

Figure 9: Status Message Example – VR Service

Table 6: Status Message

Message	VR Status Description	Action
`VR SERVICE`	VR is in Service Mode and is not operational.	Wait until current activity has completed. The status message will clear once VR is operational.
`VR LIMITED`	VR has limited functionality[4] while MSU is roaming.	Wait until MSU is back within range of its home system and the status message will clear.
`VR ERROR`	VR detected error. Display toggles between `VR ERROR` and the VR Mode and Channel info. **NOTE:** Exact error message may vary.	Radio technician support required to resolve error.[5]
`VR IN RESET`	VR is being restarted and is not operational.	Wait until restart is complete. The status message will clear once VR is operational.

[4] For a list of unsupported PSU features, refer to the manual *Vehicular Repeater Functional Description*.

[5] For full details on error codes, refer to the manual *Vehicular Repeater Programming Guide*.

Message	VR Status Description	Action
VR DISABLED	VR is disabled on selected Mobile Subscriber Unit (MSU) Channel and is not operational. **NOTE:** Applicable only if VR Disabled channels are configured.	Select a VR Enabled MSU Channel and the status message will clear.
VR WARNING	VR detected warning. Display toggles between specific warning message (for example, TRANSL TG WARN) and the VR Mode and Channel info. **NOTE:** Exact warning message may vary.	Radio technician support required to resolve warning.[6]

5.5.3
DVRS Button

The DVRS (Digital Vehicular Repeater System) button provides the ability to change Vehicular Repeater (VR) Mode and VR Channel, or access to the DVRS Menu. Options for the short and long DVRS button press are configurable. For example, a short press to toggle the VR between OFF and active mode, and a long press to access the DVRS menu. Check with your administrator to determine the button presses for each option.

NOTE: Active VR mode is either SYSTEM or LOCAL, depending on how configured.

5.5.3.1
Changing VR Mode Using Single Button Press

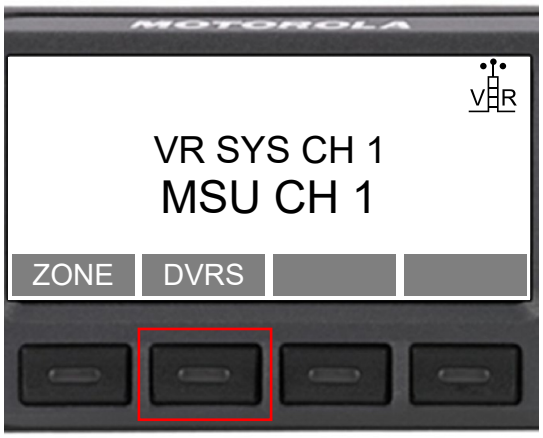
Prerequisites: The Vehicular Repeater (VR) is in active mode.

NOTE: The VR can either be in active of OFF mode. The following example shows the VR in active (SYSTEM) mode.

[6] For full details on warning messages, refer to the manual *Vehicular Repeater Programming Guide*.

Procedure:

Press the **DVRS** (Digital Vehicular Repeater System) button.

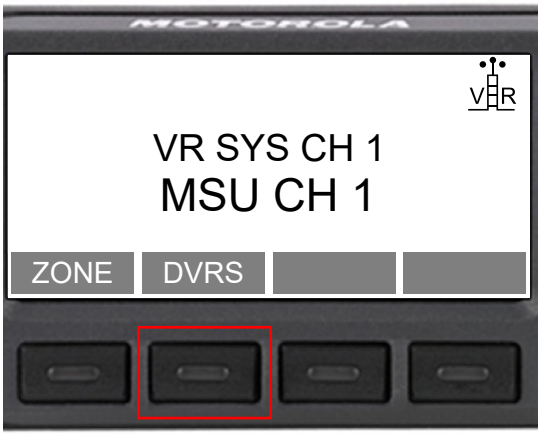


Result: The VR changes mode.

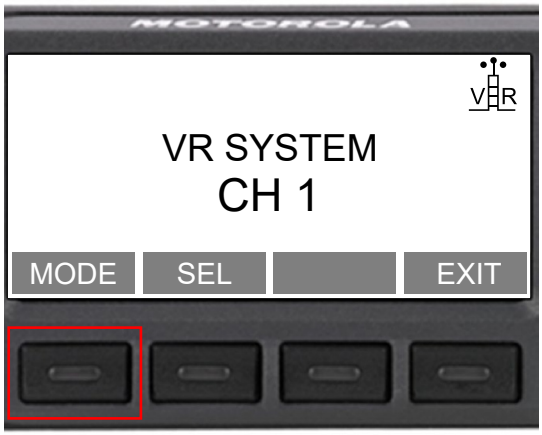
5.5.3.2
Changing the VR Mode Using the DVRS Menu

Procedure:

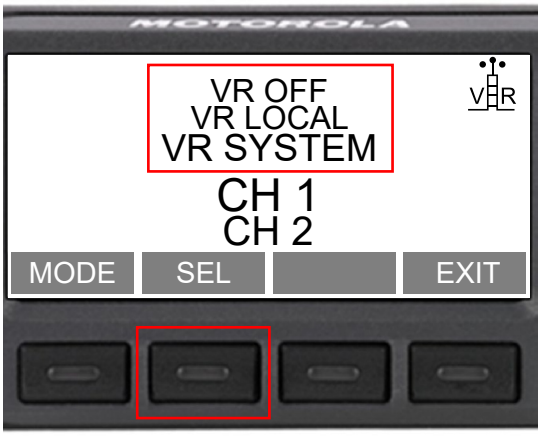
1. Press the **DVRS** (Digital Vehicular Repeater System) button.



2. Perform one of the following options:
   - Press **MODE** button to move through the available Vehicular Repeater (VR) modes until the desired mode is displayed.



   - Use the **UP** and **DOWN** buttons on Control Head to move through the available VR channels until the desired VR channel is highlighted.



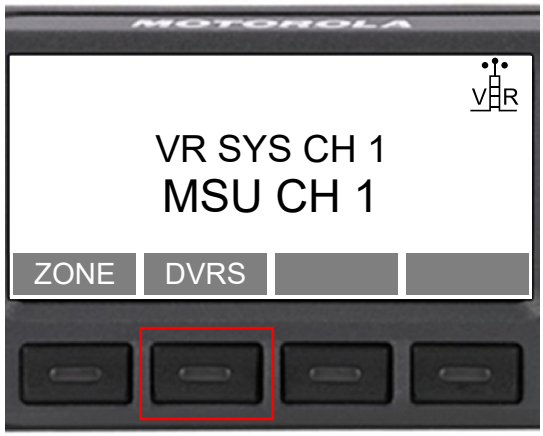
NOTE: Navigation details depend on the Control Head.

3. To confirm selection, press the **SEL** button, or wait until the DVRS menu screen timed-out and the last selected mode is saved.

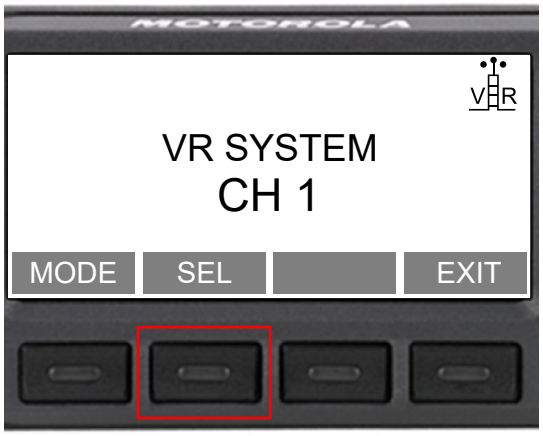
5.5.3.3
Changing the VR Channel Using the DVRS Menu

Procedure:

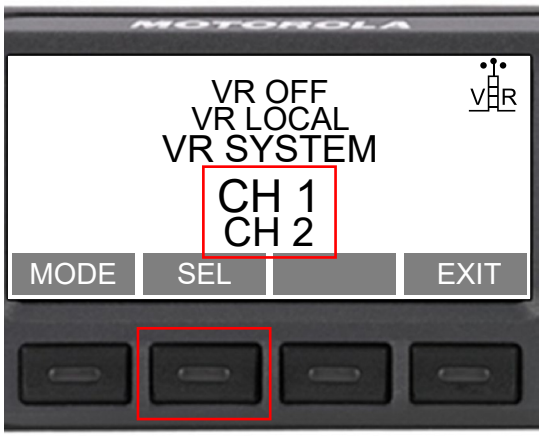
1. Press the **DVRS** (Digital Vehicular Repeater System) button.



2. Perform one of the following options:
   - Use the Navigation buttons or the Rotary Knob to scroll through the available channel until the desired channel is displayed.



- Use the **UP** and **DOWN** buttons on Control Head to highlight the desired channel.



NOTE: Navigation details depend on the Control Head.

3. To confirm selection, press the **SEL** button, or wait until the DVRS menu screen timed-out and the last selected mode is saved.

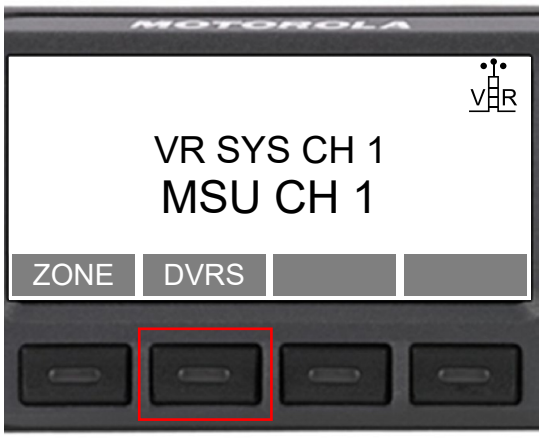
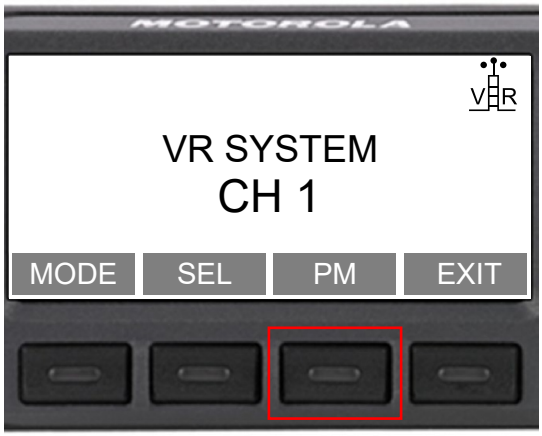
5.5.3.4

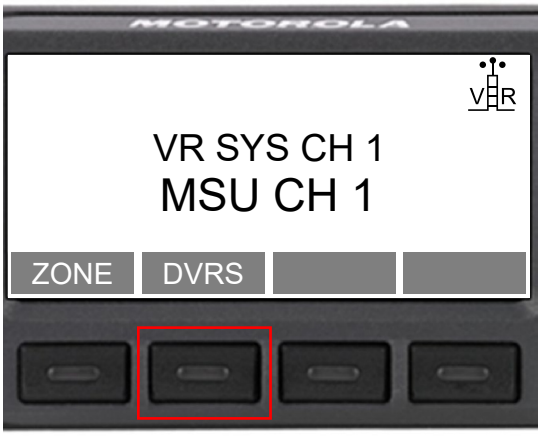
Entering/Leaving Permanent Primary State

NOTE: Option is available only if configured.

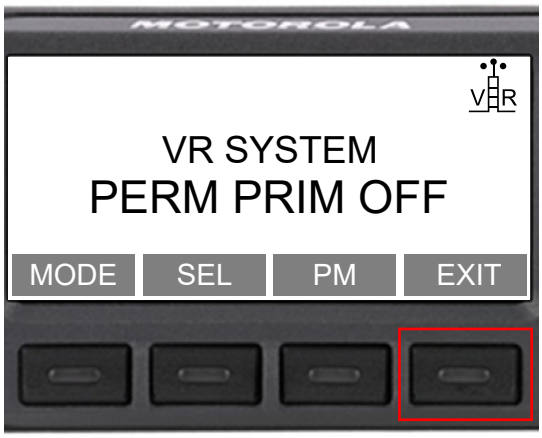
Procedure:

Use one of the following options:

Option	Action
DVRS Menu	**a.** Press the **DVRS** (Digital Vehicular Repeater System) button.  **b.** Press the **PM** (Permanent Primary) button. 

Option	Action
DVRS Button Press	Long press the **DVRS** button. 

Result: Display will indicate that state has been changed successfully. Press **EXIT** or wait until the DVRS menu screen timed-out to return to main menu.



5.5.4
VR Status Tone

The Vehicular Repeater (VR) is an audio extender as well as a network extender. Therefore, the user hears status tones on the Mobile Subscriber Unit (MSU) speaker as well as Portable Subscriber Unit (PSU) tones like what is heard when talking directly on the trunked system. For a demonstration of common VR status tones heard from PSU,watch the video *How to Series - Episode 7 - Radio Tones Through the DVRS* posted on our website. The following table indicates the VR-specific tones that are heard under the described circumstances.

Table 7: VR Status Tone

Tone Name	Description	Tone Type
VR Status Tones Heard from MSU Speaker		

Tone Name	Description	Tone Type
Invalid Menu Button Press	Indicates when a button is pressed for an invalid menu option.	Short low-pitched tone
Permanent Primary ON/OFF	Indicates when VR enters Permanent Primary state and when it leaves Permanent Primary state. **NOTE:** Applicable only if Permanent Primary is configured.	Chirping tone
Valid Menu Button Press	Indicates when a button is pressed for a valid menu option.	Short high-pitched tone
VR Control Timeout	Indicates the automatic exit of the DVRS (Digital Vehicular Repeater System) Menu. This occurs after a period of inactivity. **NOTE:** • Period of inactivity is configurable, and may also be completely disabled. • The last DVRS settings (VR channel, VR mode, Permanent Primary status) selected by the user and displayed on the MSU Control Head become active.	Long high-pitched tone
VR Mode Change	Indicates that the VR has changed modes. **1.** Using the Control Head **2.** Using AVRA/GPS	**1.** One quick tone followed by two long tones **2.** One long tone
50% Transmit Duty Cycle	Indicates that the DVRS has been transmitting more than 50% of the time over the past 30 minutes. **DANGER:** This may result in excessive RF radiation for any nearby bystanders. The users must immediately limit their talk time to comply with FCC rules.	Two short low-pitched tones
Common VR Status Tones Heard from VR Enabled PSU For a full list of status tones, see VR Status Tones – P25 PSU (Complete List) on page 42 and VR Status Tones – Conventional Analog PSU (Complete List) on page 43.		
VR Activation Tones	Indicates that the VR has been activated. For description of activation methods, see Activating the VR on page 21.	Three slow, long tones
PSU Go-Ahead Tones		
Local Access	Indicates when the user can begin talking after PTT on the PSU. **NOTE:** The VR is in Local Mode and will only be heard by local PSUs. Applicable only if Local Mode is available and the tone has not been disabled.	Three very quick, very short chirps **TIP:** Lower pitch than System Access.

Tone Name	Description	Tone Type
System Access	Indicates when the user can begin talking after PTT on the PSU. **NOTE:** The VR is in System Mode and will be heard by Dispatcher, System PSUs, and local PSUs. Applicable only if System Mode is available.	Three very quick, very short chirps **TIP:** Higher pitch than Local Access.
PSU Fallback (Talkaround)	Upon longer PTT on PSU, indicates that the PSU is out of range of the VR but direct communication with other local PSUs is possible. For example, the PSU is in talkaround mode.	One very long tone followed by four very quick, very short chirps
PSU Out of Range	Upon PTT on PSU, indicates that the PSU is out of range of the VR and communication to Dispatcher, System PSUs, or other local PSUs is not possible.	One very long tone

Chapter 6

DVRS Suitcase Deployment

The Digital Vehicular Repeater System (DVRS) Suitcase can be deployed in locations where other configurations, such as the rack or vehicle mount, are not practical.

Figure 10: DVRS Suitcase Connections

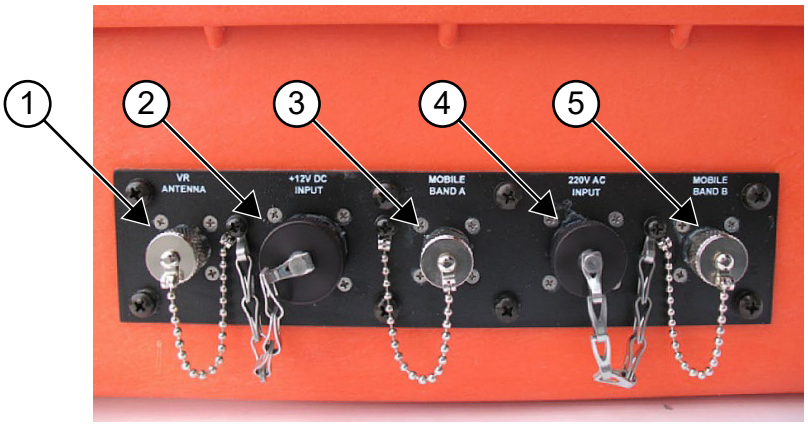


Table 8: DVRS Suitcase Connections

Annotation	Description
1	Vehicular Repeater (VR) Antenna Connection
2	Battery Pack Connection
3	Mobile Subscriber Unit (MSU) Antenna Connection Port A
4	AC Connection
5	MSU Antenna Connection Port B[7]

Procedure:

1. Connect the MSU and VR antennas to the corresponding connection ports.

   NOTE:
   Crossband Configuration
   MSU Antenna Connection Port A and MSU Antenna Connection Port B are both used for connection to the mobile.

   In-band Configuration
   MSU Antenna Connection Port A is used for Crossband connection, and MSU Antenna Connection Port B is used for In-band connection.

2. Place the MSU antenna in a location that provides optimal system coverage.
3. Place the VR antenna in a location that provides optimal local PSU coverage.
4. To prevent interference, ensure that the MSU and VR antennas are separated to provide 30 dB minimum isolation.

[7] Available only in selected models.

5. Connect the power supply either to an AC supply or a Battery Pack by using the corresponding cables.

   CAUTION: It is not recommended to connect the Battery Pack when the Suitcase is powered from an AC supply. A discharged Battery Pack can be damaged. Connecting the Battery Pack and an AC supply at the same time voids the Battery Pack warranty.

6. Open the top cover and power up the MSU. Select the required MSU Channel, VR Channel, and VR Mode.

   WARNING: The DVRS Suitcase lid must be open while the unit is in operation to ensure adequate cooling.

7. Exchange test calls with a local PSU to ensure communication is successful.
8. If necessary, change the location of the antennas for improved radio coverage.

Chapter 7

DVRS Feature Overview

The Digital Vehicular Repeater System (DVRS) offers an extensive set of features with numerous configuration options. This section contains a summary of key user features along with a brief description. For a complete list of features[8] and complete list of configuration options[9], refer to the supplementary documentation listed in Related Publications on page 14.

Table 9: DVRS Feature Descriptions

Feature	Description
VR Enabled and Disabled MSU Channels	When a Vehicular Repeater (VR) Enabled channel is selected on the Mobile Subscriber Unit (MSU), messages are repeated between system users of the selected channel (Dispatcher, System Portable Subscriber Units (PSUs)) and PSUs on the selected VR channel. When a VR Disabled MSU channel is selected, all VR functions are disabled.
Emergency Revert	When VR receives an Emergency Alarm/Call from a PSU, it changes (steers) the currently selected MSU channel to a preconfigured channel. After cancellation of the Emergency from the PSU, the VR steers the MSU back to the original channel. **TIP:** The preconfigured channel name is configurable.
In Car Monitor	Allows the user to monitor PSU voice traffic on the MSU speaker. The user will hear PSU voice from the selected VR enabled channel or all channels, depending on configuration.
MSU Fallback (Local Tx)	When MSU fails to access the system, the MSU microphone audio is rerouted and transmitted locally by the VR.
MSU Scan	The following will occur when MSU scan is enabled and a VR Enabled channel is selected: **1.** PSU initiated call will always move MSU from a landed channel back to the selected channel. **2.** Emergency Alarm/Call from a landed channel is passed through to the PSU. **3.** If the landed channel is VR Disabled, the call is not passed through to the PSU.
Permanent Primary	Allow for manual override of the automatically selected Primary. A Permanent Primary VR will always become the Primary VR in a coverage area and will be responsible for all communications. Useful for large scenes where the location

[8] See manual *Vehicular Repeater Functional Description*.
[9] See manuals *Suitcase DVRS Installation Guide* and *Vehicular Repeater Programming Guide*.

Feature	Description
	of the Primary VR becomes strategic to ensure communication reaches all local PSUs. **TIP:** VR may have Permanent Primary designation preset or, if configured, user presses the **PM** button on the Control Head to toggle Permanent Primary status ON/OFF.
Primary/Secondary	This fully automatic feature ensures interference-free communication with no user input required. When multiple VRs are in the same coverage area, one unit will be designated as Primary and is responsible for all communications. All other VRs in the coverage area become Secondary units and enter a standby state. Designation is displayed within the Status Icon on the Control Head. For more details, watch the video *How to Series - Episode 5 - Multiple DVRS at the Same Scene* posted on our website. **WARNING:** For vehicle-mount, VR must be OFF, or have a VR Disabled MSU channel selected, when the vehicle is moving.
PSU Remote VR Activation and Steering	Local PSU can send a Call Alert Page to a specific VR and remotely change the following: ● VR Mode ○ Enable PSU communication through VR with Dispatcher and System PSUs. ○ Classic Operation: mode change from OFF/LOCAL to System. For more details, watch the video *How to Series - Episode 1 - Switching On a DVRS* posted on our website. ○ Flexible Operation: cycle thru a set of preconfigured modes ● VR Status (from Secondary to Primary) ○ Ensure that the PSU communicates through specific VR rather than a distant VR as distant VR access may result in degraded audio. ● MSU Selected Channel ○ Allow the users to change the selected MSU channel and communicate with a different group of users. **TIP:** Available modes and channel steering are configurable.

Appendix A

VR Status Tones – P25 PSU (Complete List)

The following Digital Vehicular Repeater System (DVRS)-specific tones are available in the P25 Vehicular Repeater (VR) Enabled Portable Subscriber Unit (PSU).

NOTE: Tones are available only if the related mode is configured.

Tone Name	Description	Tone Type
Go Ahead Local		
Clear	Indicates that VR is in Local mode and the local PSU can begin a clear (unencrypted) voice call.	Series of short tones
Secure	Indicates that VR is in Local mode and the local PSU can begin a secure (encrypted) voice call. **NOTE:** Applicable only if encryption is configured.	Series of short tones
Go Ahead System		
Clear	Indicates that VR is in System mode and the local PSU can begin a clear (unencrypted) voice call.	Series of short tones
Secure	Indicates that VR is in System mode and the local PSU can begin a secure (encrypted) voice call. **NOTE:** Applicable only if encryption is configured.	Series of short tones
Low Battery	Indicates that the battery voltage has dropped below the configured threshold. **NOTE:** The threshold value is configurable.	Low pitched tone every 30 seconds
Inactivity Timer	Indicates that VR will switch from SYSTEM/LOCAL to OFF. Sent once a minute for the last 5 minutes prior to switching off.	Two short tones
Queued Call	Indicates that local PSU call has been queued, waiting for the Go Ahead System tone.	Series of short tones
VR Active	Indicates that the VR has been activated.	Three tones

Appendix B

VR Status Tones – Conventional Analog PSU (Complete List)

The Vehicular Repeater (VR) in analog mode can be configured to send the following tones to the analog local Portable Subscriber Units (PSUs).

NOTE: All PSUs that are in the analog mode VR radio coverage area and on the VR channel will hear the VR status tones.

Tine Name	Description	Tone Type
Emergency ACK	Indicates that VR received an MDC1200 emergency issued by a local PSU.	Configurable or default (three short tones) **NOTE:** Tone is configurable.
Encrypted Call	Indicates that Mobile Subscriber Unit (MSU) is receiving an encrypted call. The tones are heard until the encrypted call ends.	One tone
Leading Deny	Indicates if the channel is available for local PSU voice call. Initial PTT on Local PSU is released to wait for the leading tone. If the Go Ahead tone is heard, then local PSU may proceed with a second PTT and begin a voice call.	Long low-pitched tone
Leading Go Ahead		Three short tones
Low Battery	Indicates that the battery voltage has dropped below the configured threshold. **NOTE:** The threshold value is configurable.	A single low-pitched tone every 30 seconds
No Activity Timer Expiration	Indicates that VR will switch from SYSTEM/LOCAL to OFF. Sent once a minute for the last 5 minutes prior to switching off. **NOTE:** Available modes are configurable.	Two short tones
Trailing Access Denied	Indicates that the system was not reachable and the PSU call was only repeated locally. No further PTT attempts will be successful. Radio technician support is required to resolve access issue. Tone heard after the local PSU PTT was released. **NOTE:** • Lack of a trailing tone indicates that the PSU user is outside of VR range. • Local repeat of PSU calls only applicable to DVR/DVR-LX®. Not applicable for VRX1000.	Single low-pitched tone

Tine Name	Description	Tone Type
Trailing Successful System Access	Indicates that transmission was successful and the PSU call was sent to System Users. Tone heard after the local PSU PTT was released. **NOTE:** Lack of trailing tone indicates that the PSU user is outside of VR range.	Single high-pitched tone
Trailing Unsuccessful System Access	Indicates that the system was not reachable and the PSU call was only repeated locally. Subsequent PTT attempts may be successful. Tone heard after the local PSU PTT was released. **NOTE:** • Lack of a trailing tone indicates that the PSU user is outside of VR range. • Local repeat of PSU calls only applicable to DVR/DVR-LX. Not applicable for VRX1000.	Longer low-pitched tone
VR Activation	Indicates that the VR has been activated.	Configurable number of tones, tone duration, and frequencies. **NOTE:** Tone is configurable.

Glossary

Active Permanent Primary Active Permanent Primary VR is responsible for all communications in its coverage area. All other VRs in the coverage area are in Secondary state. A Permanent Primary VR has higher priority than a Primary VR, and will force a Primary VR into Secondary state.

Automated Vehicular Repeater Activation (AVRA) Programmable feature that permits automated activation of the Vehicular Repeater (VR) by either using a VIP input on the MSU Channel or DEK, or a pin on the VR Auxiliary cable. Requires external logic or switches not supplied with the VR hardware.

Channel A group of characteristics, such as transmit or receive frequency pair, radio parameters, and potentially encryption encoding.

Digital Vehicular Repeater System (DVRS) The complete equipment package of a Vehicular Repeater interfaced with a Remote Mount APX Mobile radio with or without Control Head.

Global Positioning System (GPS) A method of location that is based on reception of multiple satellite signals by a device on the ground or in an airplane. GPS is a Global Navigation Satellite System (GNSS), launched by the U.S. Department of Defense and operated by U.S.A. Air Force Space Command (AFSPC).

LOCAL Mode VR mode that provides extended portable-to-portable voice and data range by repeating Local PSU, or 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.

Local Tx Fallback A field in Motorola Solution CPS. When enabled, the MSU operating in DVRS SYSTEM mode reverts to LOCAL mode when communications with the FNE fails.

Mobile Subscriber Unit (MSU) A mobile subscriber unit.

Mode

MSU/PSU
A programmed combination of operating parameters.

VR
OFF, SYSTEM, or LOCAL

Primary An active VR that has won the Primary/Secondary negotiation. Responsible for handling communication at a scene.

Portable Subscriber Unit (PSU) A portable subscriber unit.

Push-to-Talk (PTT) A method that allows a radio user to initiate or join a call. When the user presses the PTT button or switch (also known as keying up), the radio sends data to the network infrastructure to request call services. When the PTT is released, the unit returns to receive operation.

Secondary An active VR that has lost Primary/Secondary negotiation.

Standby Permanent Primary Standby Permanent Primary VR is not responsible for communications. There is an Active Permanent Primary already present in the coverage area. If the Active Permanent Primary leaves, the Standby will become the new Active Permanent Primary VR.

SYSTEM Mode VR mode that provides extended voice and signaling communications between System Users and Local Portable users over the selected VR channel or Mobile Radio Mode.

System PSU A PSU that communicates directly with the system.

Talkgroup A uniquely named group of radios that can share calls and messages. A talkgroup normal

communications do not require interfacing with other talkgroups. Typically, the majority communications of a radio user are within their own talkgroup.

Vehicular Repeater (VR) It applies to any of the following products: DVR, DVR-LX®, and VRX1000.