



Futurecom Systems Group, ULC

DVR  
APX Series P25 Interface  
User's Manual

## NOTES

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## Foreword

This manual provides User guidelines for the Futurecom Mobexcom P25 Digital Vehicular Repeater (**DVR**) interfaced to a remote mount Motorola APX mobile radio:

Mobile Radio Model	Firmware Requirements	Notes
APX5500	R16.00.00 or later	Requires option <b>GA00631</b>
APX6500	R16.00.00 or later	Requires option <b>GA00631</b>
APX7500	R16.00.00 or later	Requires option <b>GA00631</b>
APX8500	R16.01.00 or later	Requires option <b>GA00631</b>
<b>NOTE:</b> Mobile Radio must be configured as Remote Mount in order to be compatible with the DVRS.		

When the DVR is interfaced to a compatible P25 capable Motorola Mobile Radio, the complete equipment package is referred to as Digital Vehicular Repeater System (**DVRS**).

The DVR may also be used as a standalone (Tactical) repeater. The operation of the Tactical DVR is described in publication 8A083X21.

For details on the APX Interfaced DVRS Installation and Programming Guidelines, please refer to publication 8M083X025.

For details on the Motorola APX series mobile radios, please refer to the applicable User's Manuals available from Motorola.

## Manual Revisions

Rev #	Date	By	Notes & References
0	July 2, 2013	KG	Original Release
1	December 8, 2014	KG	Firmware R1.10 Update
2	July 22, 2015	KG	Firmware R1.20 / SR7.15.5 Update
3	September 3, 2015	KG	Removed APX2500/APX4500
4	October 14, 2015	KG	Firmware R1.21 / R14.04.00 Update
5	February 10, 2016	KG	Firmware R1.22 / R14.50.00 Group Services
6	October 11, 2016	SN	Firmware R1.30/SR7.17 Update
7	February 28, 2017	SN	Removed APX2500/APX4500
8	April 18, 2017	SN	Firmware R1.40 /SR7.17.5
9	May 1, 2017	SN	Updated APX8500 Firmware version



## Firmware

**The DVRS Operation described in this Document requires the following Firmware:**

APX Mobile Radios - firmware release: **Host R16.00.00 or later.**

APX 8500 Mobile Radios - firmware release: **Host R16.01.00 or later.**

APX Mobile Radios operating as the host mobile for the DVR require subscriber option **GA00631** for operation.

XTS1500 / XTS2500 / XTS5000 - firmware release **R17.01.01 or later.**

APX2000 / APX4000 / APX6000 / APX7000 / AP8000 – firmware release **R16.00.00 or later.**

APX Portable Radios operating through a DVR, utilizing the enhanced DVR digital feature set require subscriber option **QA00631**.

DVR must be loaded with firmware release:

**Application 4C083X11 R01.40 or later.**

Tweaker Programming software **6A083X05** – Version **1.14 or later.**

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- (ii) Defects or damage from improper installation, testing, operation, or maintenance.
- (iii) Defects or damage due to alterations, modifications or adjustments carried out by the Buyer without Futurecom's explicit approval.
- (iv) Defects or damage from misuse, accident, water or neglect.
- (v) Freight costs to the repair depot.
- (vi) Scratches or other cosmetic damage to the product surfaces that does not affect the operation of the product.
- (vii) Normal wear and tear.

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Futurecom's sole obligation shall be to repair or replace, at Futurecom's option, any defective component or item and pay transportation expenses for such replacement at no charge to Buyer who shall provide labor for the removal of the defective component or item and installation of its replacement at no charge to Futurecom. Buyer shall bear all risk of loss or damage to returned goods while in transit. In the event no defect or breach of warranty is discovered by Futurecom upon receipt of any returned item, the item will be returned to Buyer at Buyer's expense and Buyer will reimburse Futurecom for the transportation charges, labor and associated charges incurred in testing the allegedly defective item.

Except as expressly provided herein, Futurecom makes no warranty of any kind, expressed or implied, with respect to any goods, parts and service provided by Futurecom including, but not limited to, the implied warranties or merchantability and fitness for a particular purpose. The sole and exclusive remedy for breach of any warranty is limited to the remedies provided in the paragraph above. Futurecom shall not in any event be liable for any other damages arising out of or in connection with furnishing of goods, parts or service hereunder, or the performance, use of, or inability to use any goods, parts or service, or otherwise, whether based on contract, tort or any other legal theory.

To exercise this warranty, please contact Futurecom's Administration Department in Concord, Ontario, Canada at 1-800 701 9180 to obtain a return material authorization (RMA) and shipping instructions. No product will be accepted for return without an RMA. The repair of a product by Futurecom pursuant to this warranty is warranted for the balance of the original warranty period, or at least 90 days from date of shipment to Buyer of the repaired product.

## Notations Used in This Manual

The following notations are used throughout this document:

**NOTE:**

A clarifying statement that expands on the text that follows.

**IMPORTANT!**

An important statement that should be considered and / or implemented in order to achieve adequate equipment operation.

**ATTENTION!**

An instruction that must be followed to insure compliance with the appropriate standards or proper equipment operations.

## Declaration of Conformity

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.

### **FCC LABELS:**

**This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:**

**(1) This device may not cause harmful interference.**

**and**

**(2) This device must accept any interference received, including interference that may cause undesired operation.**

## RF Energy Exposure Compliance, Awareness and Control Information and Operational Instructions

### **ATTENTION!**

Changes or modifications not expressly approved by Futurecom Systems Group, ULC. could void the User's authority to operate the equipment. To satisfy FCC/IC RF exposure requirements for mobile transmitting devices, the minimum separation distances specified in the "RF Safety" Book 8F083X03 (shipped with the DVRS) should be maintained. To ensure compliance, operations at closer than this distance is not allowed.

### **ATTENTION!**

Futurecom requires the P25 DVRS operator to ensure FCC 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" book shipped with the DVR. 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). It is the responsibility of the repeater operator to ensure MPE limits are observed at all times during repeater transmissions. The repeater operator must ensure at all times that no person comes within MPE distance from the vehicle body.

### **ATTENTION!**

The Transportable (suitcase) DVRS ships without an APX Mobile radio. Once an APX Mobile radio is installed, refer to the Product Safety and RF Exposure booklet 8F083X03 enclosed with your DVRS. Refer to the vehicle installation guidelines for vehicle installation. For fixed site installation, refer to the Fixed DVRS Site Antennas section.

## Introduction

The P25 DVR allows Portable Subscriber Units (**PSU**) to be used in areas where only MSU coverage is available and PSU coverage is either intermittent or nonexistent. Installed in the trunk of a car, fire truck, armored vehicle, ambulance or configured as a Transportable or Fixed mount DVR, the P25 DVRS extends radio communications when the PSU users are outside of the vehicle, inside a nearby building or in any portable radio marginal coverage areas. The P25 Digital Vehicular Repeater (**DVR**) is designed to be seamlessly interfaced to a compatible remote mount APX series Digital Mobile Subscriber Unit (**MSU**) with or without Control Head (CH).

The DVR may also be used as a standalone (Tactical) repeater. The operation of the Tactical DVR is described in publication 8A083X21.

The DVR extends voice (clear or encrypted) communications as well as key trunking system features. It can be configured to provide various advanced options to the PSU users.

The following table summarizes the DVRS compatibility scenarios:

Portable Radio Type / Mode	FIXED NETWORK TYPE / MOBILE RADIO MODE				
	Conventional Analog MSU	Conventional P25 MSU	3600 Analog / Digital Trunking MSU	P25 Trunking Phase I (FDMA) MSU	P25 Trunking Phase II (TDMA) MSU
Conventional Analog PSU	YES A	YES A/M	YES A	YES A/M	YES A
Generic Conventional P25 PSU	NO	YES D/M	NO	YES D/M	NO
DVRS Enabled Conventional P25 PSU	YES FA/FA-All	YES D/FA/M/ FA-All	YES FA/ FA-All	YES D/FA/M/ FA-All	YES D/FA/M/ FA-All

**Table 1 DVRS Compatibility Scenarios**

\*DVRS Channel Types:

A = Analog

D = Digital

M = Mixed

FA = Forced Analog

FA-All= Forced Analog All

## Identifying Your DVRS Model

### *Frequency Band of Operation*

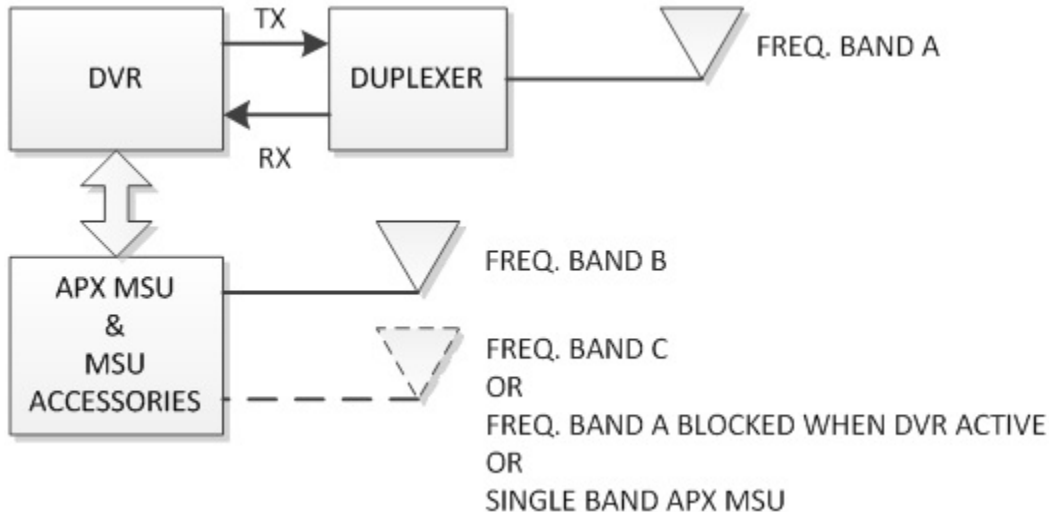
Depending on the frequency band of operation of the APX Series Mobile Subscriber Unit (MSU) and DVR, the DVRS models are classified as follows:

- **In-Band** – when the MSU and DVR operate in the same frequency band.
- **Cross-Band** – when the MSU and DVR operate in two different frequency bands.

### *Cross-Band*

Cross-Band DVRS models do not include any filters on the MSU side since the MSU and DVR are not intended to simultaneously operate in the same frequency band. In single band MSU configurations the MSU and DVR operate in different frequency bands.

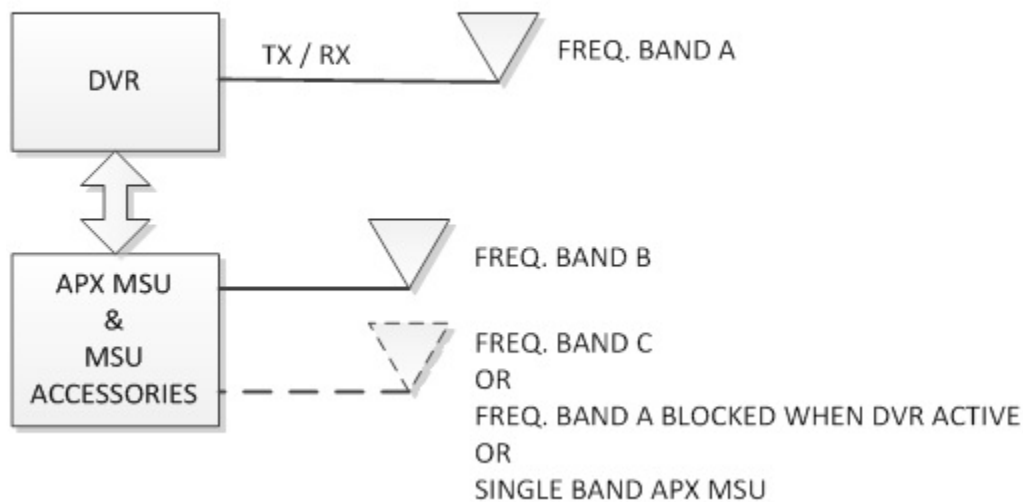
In dual band MSU configuration either the MSU & DVR operate in 3 different frequency bands or one of the MSU frequency bands is locked out when DVR operation is enabled as shown on **Figure 1**.



**Figure 1 Cross-Band Full Duplex & Simplex Capable DVRS - Conceptual Diagram**

The Cross-Band DVRS typically includes a duplexer which can accommodate full duplex and simplex DVR operation as shown on **Figure 1**. The cross-band duplexer however has a limited pass-band window and is tuned to the DVR frequencies provided on the purchase order.

As an option, a cross-band DVRS can be configured for simplex **only** operation as shown on **Figure 2**. In this case the DVRS does not utilize any filters.



**Figure 2 Cross-Band Simplex Only Capable DVRs - Conceptual Diagram**

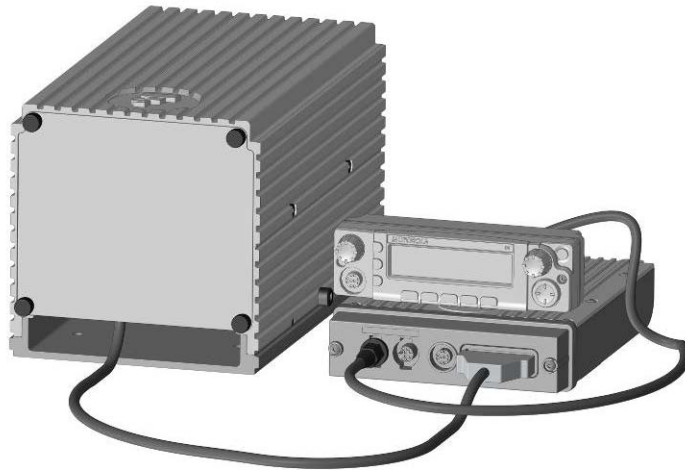
**NOTE:**

The vehicular (side-by-side) mount Cross-Band DVR can be interfaced to a High Power MSU, however, the Transmit power of the MSU must be reduced to comply with the maximum power restrictions described in the **RF Safety Booklet 8F083X03**, which is provided with the DVR.

**IMPORTANT!**

The DVRs is shipped equipped with custom filters tuned to the specified frequency range provided by the Customer. Programming the DVR / MSU to operate on frequencies outside of the original specified bands may result in intermittent or complete loss of communications. Frequency changes may require filter retuning or replacement.





**Figure 3 Vehicular Mount Cross Band DVRS Model – Full Duplex & Simplex Capable**



**Figure 4 Vehicular Mount Cross Band DVRS Model - Simplex Only Capable**

### ***In-Band***

The in-band DVRS models are equipped with two sets of filters, which are required in order to ensure interference-free operation when both the MSU and DVR are transmitting and receiving simultaneously in the same frequency band. The DVR is a full duplex capable repeater, equipped with a duplexer, which provides sufficient isolation to prevent desense during DVR repeat activation. The DVR duplexer also provides 40 dB isolation on the Mobile radio transmit / receive frequencies. The filters installed at the output of the MSU are designed to provide 40 dB isolation on the DVR transmit and receive frequencies.

#### **IMPORTANT!**

**The above filtering isolation must be complemented by 30dB minimum antenna isolation (between the DVR and Mobile Radio antennas) in order to ensure interference-free operation. It is recommended that the Mobile antenna is mounted on the roof of the vehicle while the DVR antenna is mounted on the trunk. Each DVRS is equipped with custom filters tuned to the specified frequency bands – note the frequency range specified on the filter Labels. Programming the DVR / Mobile radio to operate on frequencies outside of the original specified bands may result in intermittent or complete loss of communications. Frequency changes may require filter retuning or replacement.**

The in-band DVRS models are also equipped with an RF bypass switch, which bypasses the filtering at the output of the MSU when a “DVR – Disabled” TG is selected on the MSU control head (see **Figure 5**).

When a “DVR – Enabled” TG is selected on the MSU CH, the RF switch automatically connects the extra filters between the MSU antenna port and the MSU antenna to ensure interference-free operation.

The complex in-band filtering is only feasible if sufficient frequency gap is present between the DVR frequencies and the MSU frequencies associated with the “DVR - Enabled” TGs. For more information on the feasible filtering options, please refer to the DVRS Ordering Guides.

As an option, an in-band DVRS can also be configured as simplex only (**Figure 6**). The simplex in-band configuration however still requires DVR and in-band filters.

#### **NOTE:**

The DVR and MSU always require two (or three in the case of dual band MSU) separate antennas.

#### **NOTE:**

The In-Band filters connected to the MSU have typical insertion loss of 1.5dB.

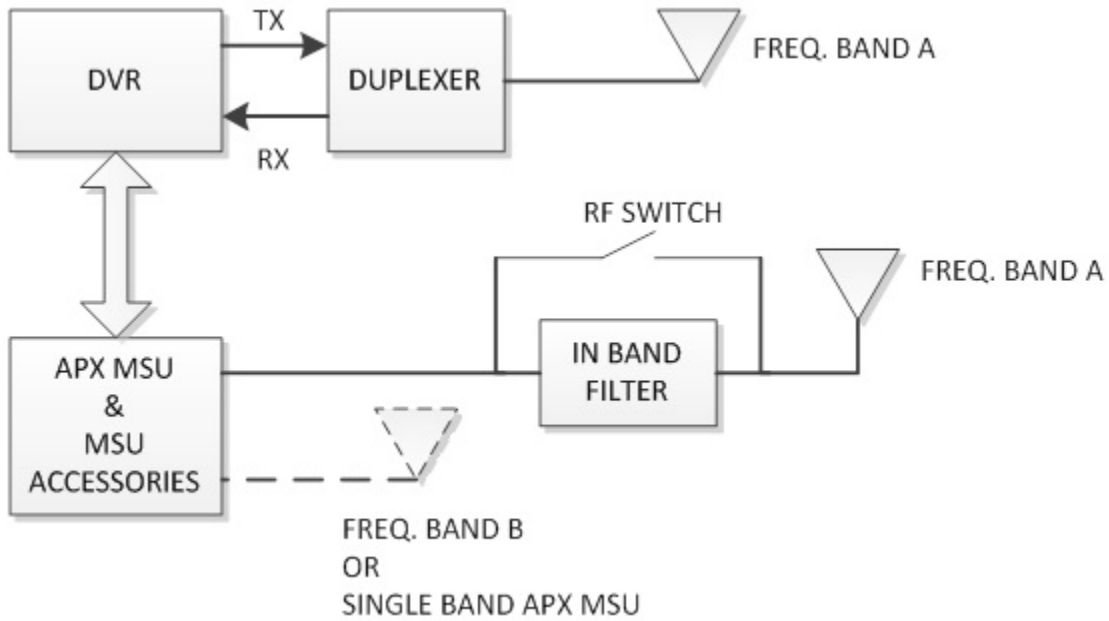


Figure 5 In-Band Full Duplex / Simplex Capable DVRS - Conceptual Diagram

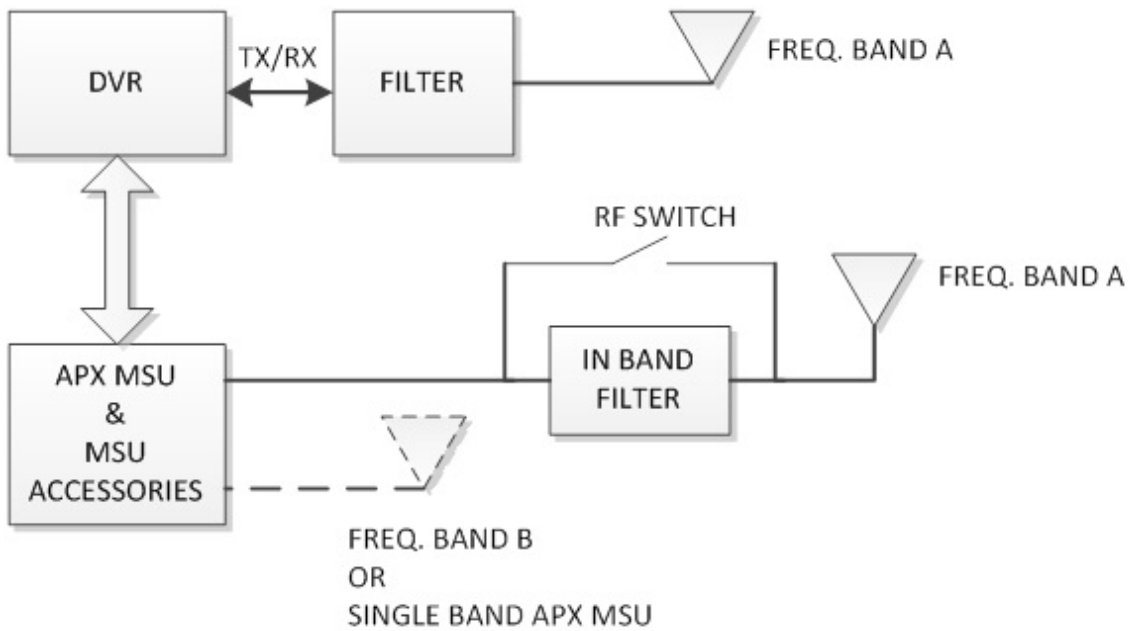
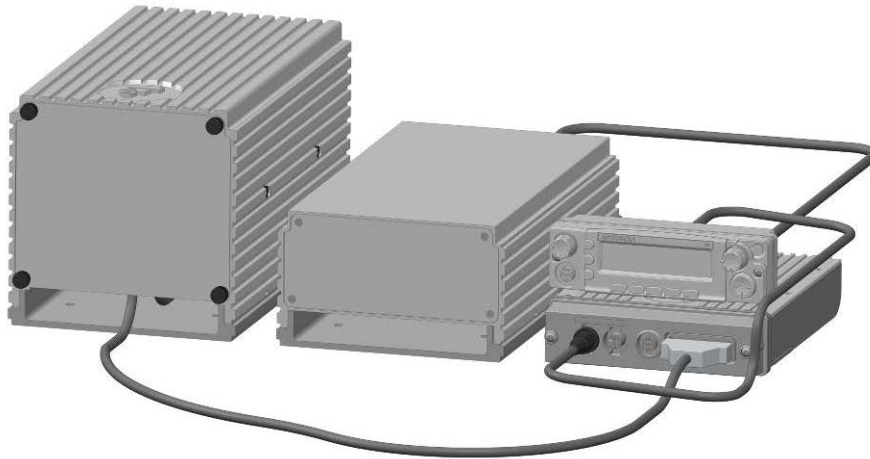
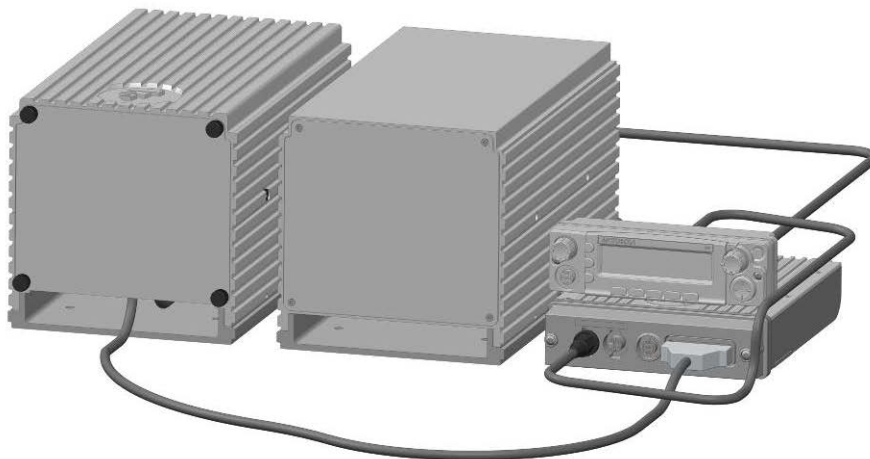


Figure 6 In-Band Simplex Only Capable DVRS - Conceptual Diagram



**Figure 7 Vehicular Mount In-Band 700 or 800MHz DVRS Model - Full Duplex & Simplex Capable**



**Figure 8 Vehicular Mount In-Band VHF or UHF DVRS Model - Full Duplex & Simplex Capable**

### ***Band Locking***

When both the MSU and DVR are configured to operate in the same frequency band, the DVRS requires a special set of filters including and in-band filter placed at the MSU antenna port. The special in-band filters are required in order to prevent interference when the DVR and MSU are activated at the same time. When the in-band filter is not present ('MSU RF Bypass switch' in the Tweaker Hardware setup screen is unchecked), the Band Lock feature is enabled by default and the Tweaker prevents DVR operation on MSU channels that are explicitly using the same frequency band as the DVR. On MSU channels where the frequency band is not explicitly known such as in multi-site trunking systems, the MSU will be prevented from using frequencies in the same band while the DVR is active (i.e. in SYSTEM or LOCAL mode). In this case the MSU will no longer allow roaming to sites using the locked out band. If the MSU is currently on a trunking site that uses the locked out band, the MSU will roam to another site. If no other sites are available, the MSU will become Out Of Range. When the DVR is inactive (OFF mode), the MSU frequency band is unlocked.

If Band Locking is disabled in the Tweaker, the MSU is allowed to roam to any site regardless of the frequency band. A typical in-band application that may require Band Locking to be disabled is the Fixed DVRS application when the MSU and DVR antennas are mounted in such way as to provide minimum 70dB of isolation and in-band filtering is not required.

For MSU conventional channels where the band is known and fixed, the DVR restricts access to channels using the locked out frequency band.

If Band locking is enabled in the DVR and SCAN is enabled in the MSU, the MSU will skip over any channels in the scan list that are configured to operate in the same frequency band as the DVR.

For information on MSU Scan operation and limitations, please refer to the **MSU Scan** section of this document.

### ***Transportable DVRS***

The Transportable DVRS is packaged in a durable suitcase and includes all necessary electronics and filtering. The transportable unit can be easily deployed in the field and is powered up either by plugging into an AC outlet or by using an optional battery backup kit. The battery backup kit is also packaged in a suitcase for ease of transportation.

The transportable model requires two or three antennas – one or two connected to the MSU and one to the DVR. The MSU antenna needs to be strategically deployed in order to ensure reliable link between the MSU and the radio system infrastructure. The DVR antenna needs to be positioned to provide optimum radio coverage for the portable radio users.

### ***Fixed DVRS***

The fixed DVRS model is housed in a wall-mount indoor enclosure and includes all necessary electronics and filtering. The fixed DVRS is intended for permanent i.e. 'Fixed' type installations



***Cabinet Mount***

***Suitcase Mount)***

***Battery Pack***

***Standalone P25I Repeater***

The indoor fixed mount DVRS models can be upgraded to outdoor enclosure by adding option **TT05130AA** as described in the DVRS Ordering Guide.

### ***P25 Tactical Repeater with Backpack option***

The P25 Tactical Repeater comes in a Backpack Frame (optional) designed for comfort and stability.

When used as a Tactical Repeater, the full duplex DVR provides extended portable-to-portable radio capabilities by receiving the analog or digital signals sent by a portable radio and retransmitting them to the other portable radios in the area

## DVRS Operation Basics

The operation of the DVRS is determined by the following:

- Firmware options and programming settings of the DVR (DVR personality).
- Firmware options and programming settings of the APX MSU interfaced to the DVR.
- Configuration capabilities and programmed settings of the radio system.
- Type and programming settings of the portable radios used for communications through the DVR.

### **IMPORTANT!**

**Depending on the selected personality settings and configuration capabilities of the complete radio system infrastructure, the features / options described throughout this document may or may not be applicable to the specific DVRS operation.**

## DVRS Features by PSU Type – Motorola Infrastructure

When the PSU user is out of system radio coverage, the PSU can be switched to a dedicated DVR channel so that the PSU can communicate via the DVRS. The features available to the PSU user depend on the PSU type, programming and selected mode.

The table below specifies what features are supported by the different PSU types.

PSU FEATURE SUPPORT BY DVRS	DVRS Enabled PSU [Note 5]	Generic P25 PSU	Analog PSU
<b>Registration / Deregistration</b>	Yes	Yes [Note 1]	Yes [Note 3]
<b>Talk Group Proxying / Translation</b>	Yes	Yes	No
<b>Group Calls</b>	Yes	Yes	Yes
<b>PSU PTT ID</b>	Yes	Yes	Yes [Note 2]
<b>Private Calls</b>	Yes	No	No
<b>Announcement Group</b>	No	No	No
<b>Phone Interconnect</b>	Yes	No	No
<b>Patch</b>	Yes	No	No
<b>Dynamic Regrouping</b>	Yes	No	No
<b>Selector Lock / Unlock</b>	No	No	No
<b>Emergency Call / Alarm</b>	Yes	Yes	Yes
<b>Emergency ID Pass Through</b>	Yes	Yes	Yes [Note 2]
<b>PSU Hot Mic</b>	Yes [Note 4]	No	No
<b>PSU Emergency Revert</b>	Yes	Yes	Yes
<b>P25 Encryption</b>	Yes	Yes	No
<b>Call Alert /Page</b>	Yes	Yes	No
<b>System Status Broadcast (Failsoft, Out Of Range, Site Trunking)</b>	Yes	No	No
<b>Local Mode Indication</b>	Yes	No	No
<b>Automatic Revert to TA when no DVR</b>	Yes	No	No
<b>Adaptive Power Control</b>	Programmable	Yes [Note 6]	No
<b>Talk Permit Tones (generated by PSU)</b>	Yes	No	No
<b>Leading / Trailing Tones (sent over the air)</b>	No	No	Yes
<b>Radio Check / Radio Inhibit</b>	Yes	Yes	No
<b>P25 Trunking OTAR</b>	Yes	No	No
<b>PSU Group Services</b>	Yes [Note 7]	No	No
<b>PSU LOCATION</b>	Yes	No	No
<b>PSU SCAN</b>	No	No	No
<b>Remote DVR Activation by PSU</b>	Yes (Call Alert)	Yes (Call Alert)	Yes (DTMF)
<b>Remote DVR Activation by PSU Emergency Alarm</b>	Yes	Yes	Yes (MDC1200)

**Table 2 DVRS Features vs Type of PSU**

Note 1 When selecting a DVR Mode on the Generic P25 PSU, it registers upon first Group Call. Generic PSU is deregistered after a preprogrammed timer counting the period of inactivity expires.

Note 2 Supported only with MDC1200 capable portables.

Note 3 Analog PSU is registered on the P25 system with its MDC1200 ID.

Note 4 Requires firmware R12.00.13 or later in the XTS 'DVRS Enabled' PSU and R07.00.05 or later if using APX 'DVRS/VRX Enabled' PSU.



Note 5 The PSU models that can be programmed as **DVRS Enabled** are described in **Table 6**. Note 6: Motorola Solutions XTS or APX series PSUs in non DVRS/VRX Enabled mode. Note 7: Group services only supported on APX 'DVRS Enabled' PSUs (R14.50.00 or later in PSU/MSU).

## 'DVRS Enabled' PSU Features Support in Non-Motorola Infrastructure

'DVRS ENABLED' PSU FEATURE SUPPORT	HARRIS P25 Trunked FDMA	CASSIDIAN P25 Trunked FDMA
PSU Registration / Deregistration	Yes	Yes
PSU Talk Group Proxying / Translation	Yes	Yes
In Car Monitor	Yes	Yes
MSU MIC PTT with DVRS ON	Yes	Yes
PSU Group Calls	Yes	Yes
PSU PTT ID	Yes	Yes
PSU Private Call II *	Yes	Yes
PSU Emergency Call / Alarm	Yes	Yes
PSU Emergency ID Pass Through	Yes	Yes
PSU Hot Mic	Yes	Yes
PSU P25 Encryption	Yes	Yes
PSU Call Alert Page	Yes	Yes
Out Of Range / Site Trunking indication on PSU	Yes	Yes
DVRS OOR indication on PSU	Yes	Yes
FNE NO COMMS indication through DVRS	Yes	Yes
DVRS Local Mode Indication on PSU	Yes	Yes
Talk Permit Tones (generated by PSU)	Yes	Yes
PSU Radio Check / Radio Inhibit	Yes	Yes
PSU P25 Trunking OTAR	Yes - Limited	Yes
PSU Adaptive Power Control	Yes	Yes
PSU Phone Interconnect	Yes	Yes
PSU Patch & Simulselect	Yes	Yes
PSU Dynamic Regrouping	Not Supported	Not Supported
Automatic Revert to TA when no DVR	Yes	Yes
PSU LOCATION	Yes	Yes
Remote DVR Activation by PSU Call Alert Page to DVR ID	Yes	Yes
Remote DVR Activation by PSU Emergency Alarm Retries	Yes	Yes
PSU Status / Message	Yes	Yes
Remote MSU Channel Steering via PSU Call Alert Page to DVR ID	Yes	Yes
Data	Not Supported	Not Supported
PSU OTAP	Not Supported	Not Supported
MSU Votescan	Not Supported	Not Supported
Limited Features support on P25 TDMA FNE	Yes (Group Voice, PTT-ID and Emerg Alarm/Call)	Not Supported

**Table 3 'DVRS Enabled' PSU Features Support on Non-MSI Infrastructure**

\*PC II Support only; Enhanced Private Calls are only supported on Motorola Infrastructure.

## Powering up the DVRS

The DVR powers up together with the MSU. The power up mode and channel are programmable. Depending on the programmed personality, the DVR can power up in one of the following states:

- DVR Disabled mode, last selected DVR channel
- OFF mode
- SYSTEM mode, last selected DVR channel
- SYSTEM mode, preprogrammed DVR channel
- LOCAL mode, last selected DVR channel
- LOCAL mode, preprogrammed DVR channel
- If the DVRS powers up on a 'strapped' mobile radio channel, the DVR will be steered according to the Talk Group selected on the MSU. The steering may involve both DVR channel and mode change.

## Turning ON the DVRS

When the MSU is powered up, the DVRS can be activated by one or more of the methods described in the following section.

- The DVR is ON when SYSTEM (or optionally LOCAL) mode of operation is selected.
- The DVR is OFF when OFF mode is selected.
- The DVR is disabled when a "DVR Disabled" Mode / Channel is selected on the APX MSU or if the currently selected DVR and MSU modes are incompatible (such as TDMA MSU mode and P25 Digital DVR channel).

### **NOTE:**

The DVR can only be activated when a compatible "DVR Enabled" mode / channel is selected on the APX MSU.

### *Activating the DVRS via the Control Head*

Ensure the MSU is powered up and a DVR Enabled TG / channel is selected on the control head.

To activate the DVR:

- Press the **DVRS** menu item to enter the 'DVR Control Mode'.
- Once in the 'DVR Control Mode' screen, press the **MODE** button to toggle the available DVR modes until the desired mode is selected.
- Press the **SEL** button or wait 6 seconds until the 'DVR control Mode' screen times out. The last selected DVR mode becomes effective.

Pressing the **DVRS** button allows the user to enter the 'DVR Control Mode' and to select the desired DVR mode and DVR channel as described in the

**Automatic DVRS Activation (AVRA)**

The DVR can be activated automatically (switched from OFF or LOCAL to SYSTEM Mode) if one of the VIP inputs on the MSU control head is wired to the desired trigger source – portable charger switch or door switch or custom manual switch.

When AVRA is enabled in the DVR, the user still has the option of manually changing the DVR mode from the MSU control head or remotely.

The AVRA feature depends on the DVR programming as shown below:

AVRA Configuration (as programmed in DVR)	System Mode Allowed	VIP Input	Current DVR Mode	New DVR mode
Activation / Deactivation	True	Asserted	OFF	SYSTEM
Activation / Deactivation	False	Asserted	OFF	LOCAL
Activation / Deactivation	True	Asserted	LOCAL	SYSTEM
Activation / Deactivation	False	Asserted	LOCAL	LOCAL
Activation / Deactivation	True	Asserted	SYSTEM	SYSTEM
Activation / Deactivation	True/False	De-asserted	ANY	OFF
Activation Only	True	Asserted	OFF	SYSTEM
Activation Only	False	Asserted	OFF	LOCAL
Activation Only	True	Asserted	LOCAL	SYSTEM
Activation Only	False	Asserted	LOCAL	LOCAL
Activation Only	True	Asserted	SYSTEM	SYSTEM
Activation Only	True/False	De-asserted	ANY	NO CHANGE
Toggle	True	Asserted	OFF	SYSTEM
Toggle	False	Asserted	OFF	LOCAL
Toggle	True/False	Asserted	LOCAL	OFF
Toggle	True	Asserted	SYSTEM	OFF
Toggle	True/False	De-asserted	ANY	NO CHANGE

**Table 4 AVRA Functionality**

## ***Remote Activation of the DVRS***

### ***Via Call Alert (Page) to DVR***

**NOTE:**

This feature requires the use of a P25 PSU and implies Digital or Forced Analog DVRS mode of operation.

To remotely activate a DVR, the PSU user can send a Call Alert (Page) with the ID of the specific DVR.

Upon receipt of a Call Alert (Page) from the PSU the DVR will:

- Switch from OFF or LOCAL mode to SYSTEM mode (unless it is already in the SYSTEM mode). If the selected DVR / MSU channel is programmed as LOCAL only, the DVR will switch from OFF to LOCAL mode.
- Switch to Primary status and force any other Primary DVR to become a Secondary unless there is a Permanent Primary (on the same DVR channel) already present in the same area.
- Force the MSU to revert to a TG selected on the PSU (if programmed).

### ***Via PSU Emergency Alarm***

The DVR switches from OFF to SYSTEM mode after a programmable number of Emergency Alarm attempts sent by a PSU are successfully received by the DVR and are not serviced by another (Primary) DVRS.

### ***Via PSU DTMF Tones***

To remotely activate a DVR (analog mode), the PSU user can send a preprogrammed DTMF sequence, which can be received by DVRS in the PSU radio coverage area.

Upon receipt of the preprogrammed DTMF sequence from the PSU the DVR will:

- Switch from OFF or LOCAL mode to SYSTEM mode.
- Switch to Primary status unless there is already a Primary / Permanent Primary DVRS (on the same DVR channel) already present in the same area.

DTMF activation is supported on analog or mixed mode DVR channels only.

***Via System / Dispatcher Call Alert Page to MSU***

Dispatcher can send a Call Alert (Page) to a specific MSU ID, which in turn causes DVR mode change in the following order: OFF-SYS-LOC-OFF.

The MSU can be programmed to support one of the following configurations:

- a. Call Alert / Remote Activation Disabled – the MSU does not respond to any Call Alert requests
- b. Call Alert Enabled – the MSU responds to Call Alerts addressed to its ID and does NOT initiate DVRS mode change
- c. Remote Activation Enabled – the MSU will acknowledge Call Alerts addressed to its ID and will initiate DVR mode change provided the source ID of the Call Alert is programmed in the “DVR Remote Activation IDs” table.

If “Generate Status on DVR Mode Change” is enabled for a given DVRS Profile (in the APX MSU) , the MSU will send back a mode change status to indicate the current DVRS mode (OFF, SYSTEM, LOCAL). Only the dispatcher console can interpret those status messages:

DVR MODE	STATUS VALUE
OFF	1
LOCAL	2
SYSTEM	3

Dispatcher can't force a Non-Primary DVR to become a Primary and can't activate a DVR when a 'VR Disabled' mode is selected on the control head.

## Turning OFF the DVRS

### *Deactivating the DVRS via the MSU Control Head*

To deactivate the DVR via the MSU control head:

- Press the **DVRS** button to enter the 'DVR Control Mode', then press the **MODE** button until **VR OFF** is displayed and either press the **SEL** button or wait for the screen timeout (6 seconds).  
**OR**
- Select a 'DVR Disabled' TG / Mode / Zone on the MSU  
**OR**
- Power down the MSU if radio operation is no longer required.

### *Deactivating the DVRS via Call Alert sent by Dispatch*

Dispatcher can send a Call Alert (Page) to a specific MSU ID, which in turn causes DVR mode change in the following order: **OFF-SYS-LOC-OFF**.

The MSU can be programmed to support one of the following configurations:

- a. Call Alert / Remote Activation Disabled – the MSU does not respond to any Call Alert requests
- b. Call Alert Enabled – the MSU responds to Call Alerts addressed to its ID and does NOT initiate DVRS mode change
- c. Remote Activation Enabled – the MSU will acknowledge Call Alerts addressed to its ID and will initiate DVR mode change provided the source ID of the Call Alert is programmed in the "DVR Remote Activation IDs" table.

If "Generate Status on DVR Mode Change" is enabled for a given DVRS Profile (in the APX MSU), the MSU will send back a mode change status to indicate the current DVRS mode (OFF, SYSTEM, LOCAL). Only the dispatcher console can interpret those status messages:

DVR MODE	STATUS VALUE
OFF	1
LOCAL	2
SYSTEM	3

Dispatcher can't force a Non-Primary DVR to become a Primary and can't activate a DVR when a 'VR Disabled' mode is selected on the control head.

### *Automatic DVRS Deactivation*

#### **AVRA**

If the DVR is in the SYSTEM or LOCAL Mode and the AVRA VIP input is de-asserted, the DVR can be programmed to automatically switch to OFF Mode as described in **Table 4**. If the DVR is in the OFF Mode, de-asserting the AVRA VIP will not result in any change. The method of de-asserting the AVRA VIP depends on the actual installed AVRA trigger. For example, if the selected AVRA trigger is the Portable Charger Switch, de-asserting the AVRA VIP input is equivalent to placing the PSU back in the charger.

#### **Inactivity Timer**

If programmed, the DVR can switch automatically to OFF mode upon expiration of its Inactivity Timer (programmable from 0 to 180 minutes). The timer is restarted every time the DVR detects PSU activity.

## DVRS Status Display

The following MSU control head display icons / messages relate to the DVRS operation:













O5 DISPLAY ICON / MESSAGE	DVRS STATUS DESCRIPTION
Steady 	DVR is in a Primary State
Steady 	Primary DVR Receiving
Steady 	Primary DVR Transmitting
Steady 	Primary DVR Receiving and Transmitting
Flashing 	DVR is in a Secondary State
Flashing 	Secondary DVR Receiving
Steady 	DVR is in a Permanent Primary State
Flashing 	DVR is in a Permanent Primary on Standby (there is another Permanent Primary already present in the area)
Flashing 	Permanent Primary on Standby Receiving
Steady 	Permanent Primary Receiving
Steady 	Permanent Primary Transmitting
Steady 	Permanent Primary Receiving and Transmitting
<b>VR SERVICE</b>	DVR is in Service Mode (during re-flashing of the firmware).
<b>VR ERROR</b>	DVR detected error. Display toggles between VR ERROR and the actual error code / number.
<b>VR IN RESET</b>	DVR is being reset
<b>VR DISABLED</b>	DVR Disabled on selected MSU TG / Mode

Table 5 DVRS Status Display Messages / Icons



## DVRS Enabled PSUs

The following Portable Radios have firmware that allows enhanced communications with the DVR and support of an extended list of features.

PSU Models that can be 'DVRS Enabled'	PSU Firmware Revision Required
XTS1500 XTS2500 XTS5000	R9.00.00 and higher  <i>Note: It is highly recommended to always use the latest released PSU firmware to ensure all fixes and new features are included.</i>
APX4000 APX6000 APX7000 APX8000	R15.00.00 and higher  <i>Note: It is highly recommended to always use the latest released PSU firmware to ensure all fixes and new features are included.</i>  APX portable radios operating through a DVR, utilizing the enhanced DVR digital feature set require subscriber option <b>QA00631</b> .

**Table 6 DVRS Enabled PSU Models**

All other P25 capable PSU models or the above models with either older firmware versions or when not programmed as 'DVRS Enabled', can only be programmed as 'P25 Generic' since they are not capable of extended communications with the DVR.

## DVRS Status Tones

### *DVRS Status Tones - MSU Speaker*

The following DVRS specific tones will be heard in the MSU speaker under the circumstances described below:

TONE TYPE	TONE NAME	DVRS STATUS
<b>Short high-pitched tone</b>	DVRS Button Press	Indicates a valid DVRS Button press during DVRS Selection Mode.
<b>Short low-pitched tone</b>	DVR Invalid Option	Indicates Invalid DVR selection (for example when pressing the PM button when PM option is disabled).
<b>Long high-pitched tone</b>	DVR Control Timeout	Indicates the end of DVR Control Mode session. The last DVR settings (DVR channel, DVR mode, Permanent Primary status) selected by the user and displayed on the MSU control head become active.
<b>Chirping Sound</b>	Permanent Primary ON/OFF	Indicates Permanent Primary ON/OFF.
<b>Two short low-pitched tones</b>	50% Transmit Duty Cycle	Indicates that the DVR and Mobile radio transmitters have been keyed up more than 50% of the time over the past 30 minutes and any nearby bystanders may be getting excessive RF radiation. The users must immediately limit their talk time to comply with FCC rules.
<b>Single high-pitched tone every few seconds (5-255 sec. programmable)</b>	DVR Active	Indicates the DVR is either in SYSTEM or LOCAL mode (programmable). The 'DVR Active' tones are heard in both Primary and Secondary DVR modes.

Table 7 DVRS Status Tones (MSU Speaker)

***DVRS Status Tones - PSU***

***P25 'DVRS Enabled' PSU***

The following DVRS-only specific tones are available (if programmed) in the P25 PSU:

TONE TYPE	TONE NAME	DESCRIPTION
Series of short beeps	Go Ahead System (clear)	DVRS system mode talk permit tone, clear voice
Series of short beeps	Go Ahead System (secure)	DVRS system mode talk permit tone, encrypted (secure) voice
Series of short beeps	Go Ahead Local (clear)	DVRS local mode talk permit tone, clear voice
Series of short beeps	Go Ahead Local (secure)	DVRS local mode talk permit tone, encrypted (secure) voice
Low pitched tone every 30 seconds	Low Car Battery	Sent by the DVRS when the car battery voltage is below the programmed threshold
Series of short beeps	Queued Call	Call has been queued, waiting for system grant
Two short beeps	No Activity Timer Expiration	Warning tones sent to alert the PSU users that the DVR will switch from SYS/LOC to OFF. Sent every minute for the last 5 minutes prior to the switching.
Three beeps	DVR Active	Tones sent upon DVRS activation (SYS or LOC mode).

**Table 8 P25 DVRS Enabled PSUs – DVRS Specific Tones**

***Generic P25 PSUs***

'Low Car Battery', 'No Activity Timer Expiration' and 'DVR Active' tones (as described in **Table 8** above) are supported.

***Conventional Analog PSUs***

The DVR in analog mode can be configured to send the following tones to the analog PSUs:

TONE TYPE	TONE NAME	DESCRIPTION
Beep	Encrypted Call	Sent to local analog PSUs when the MSU is receiving encrypted call. The beeps are sent until the encrypted call ends.
Three Short Beeps	Leading Go Ahead	Leading tones sent by the DVR over the air upon receipt of system grant. Requires the LPSU user to do 'double PTT' in order to get a channel and release the PTT to be able to receive the Leading Tones.
Long Low pitched tone	Leading Deny	
Single high-pitched tone	Trailing Successful System Access	Trailing Tones sent by DVR in analog mode to conventional analog PSUs at the end of PSU transmission. If the transmission was unsuccessful the PSU User will know that he / she needs to repeat the message if they want to reach the system. Lack of Trailing tones would indicate that the PSU user is outside of the DVR range.
Longer Low pitched tone	Trailing Unsuccessful System Access	
Single Low pitched tone every 30 seconds	Low Battery	The Low Battery tones are sent to the local portables every 30 seconds when the battery voltage drops below the programmed threshold.
Single Low pitched tone	Trailing - Access Denied	Indicates system was busy and the portable radio call was only repeated locally.
Programmable or default (3 short beeps)	Emergency ACK	If programmed, emergency ACK tones are sent by the DVR when processing MDC1200 emergency issued by a PSU.
Two short beeps	No Activity Timer Expiration	Warning tones sent to alert the PSU users that the DVR will switch from SYS/LOC to OFF. Sent every minute for the last 5 minutes prior to the switching.
Programmable number of tones, tone duration and frequencies.	DVR Activation	If programmed, DVR generated tones are sent to the PSUs every time the DVR is activated i.e. switched to LOCAL or SYSTEM Mode.

**Table 9 Analog PSU - DVRS Specific Tones**

**NOTE:**

All PSUs which are in the analog mode DVR radio coverage area and switched to the DVR channel will hear the DVR status tones since those are transmitted over the air (on the same frequency with PL/DPL) and are NOT generated by the portable radios.

## 'DVRs Enabled' Mobile Radio TGs / Channels

DVR operation may be enabled (by the DVR and MSU programming) on selected mobile radio Talk Groups / channels and disabled on others.

When the user selects a DVRs Enabled TG / channel on the MSU control head, the DVR operation is enabled in the following manner:

- The DVR automatically enters the pre-programmed DVR mode/channel associated ('Strapped') with the selected MSU TG / channel if DVR strapping is programmed in the DVR.

OR

- The user may change the DVR mode / channel (if 'strapping' is not enabled) by pressing the assigned **DVRS** button and entering the 'DVR control mode'.
- The DVR can be activated and used to repeat messages between the system users of the TG/channel selected on the MSU and the PSU users on the selected DVR channel.
- If enabled in the DVR personality, 'DVR Enabled' tones will be heard every few seconds (5-255 sec. programmable) in the MSU speaker, regardless of the Primary / Secondary status.

## 'DVRs Disabled' Mobile Radio TGs / Channels

DVR operation may be enabled on selected mobile radio Talk Groups / channels and disabled on others.

When the user selects a "DVRS Disabled" TG / channel on the control head:

- Pressing the DVRS button results in a DVR Invalid Option Tone (single low-pitched tone).
- DVR operation is prohibited i.e. all DVR functions are disabled.
- Call Alert Page from the local PSU, sent on the last used DVR channel, can steer the MSU to a 'VR Enabled' mode if programmed accordingly.

## In Car Monitor (ICM)

The ICM feature allows the MSU to monitor PSU Voice traffic and is configurable in the MSU codeplug as follows:

- ICM is enabled / disabled globally in the MSU via the 'ICM Allowed' Field
- If 'ICM Allowed' is programmed in the MSU then ICM operation is further configured on a per MSU channel basis via the 'ICM Allowed' codeplug field.
- ICM functionality is further configured to be triggered by either Hang Up Box (HUB) on / off transitions OR via menu item / button on the MSU control head or keypad microphone.

When ICM functionality is configured to be triggered via HUB on/off then 'ICM Selected' operation takes place when the MSU microphone is placed on HUB, 'ICM All' operation will take place when the MSU microphone is taken off HUB.

For details on how to program the ICM functionality and options in the MSU, please refer to the corresponding Motorola Documentation.

When the MSU is operating on a Trunking FNE with ICM enabled the following configurations are available:

- 'ICM Selected' – the MSU speaker unmutes to PSU audio matching its selected TG ID (digital DVR channel) or all qualified analog PSU audio (analog DVR channel).
- 'ICM All' – the MSU speaker unmutes to all PSU audio regardless of the TG ID (digital DVR channel) or all analog PSU audio (analog DVR channel).

When the MSU is operating on a Conventional FNE with ICM enabled the following configurations are available:

- 'ICM Selected' and MSU configured for Selective Squelch – the MSU speaker will unmute only to PSU audio matching its selected TG (digital DVR channels) or qualified analog audio (analog DVR channels)
- 'ICM Selected' and MSU configured for Normal Squelch – the MSU speaker will unmute to any PSU TG audio (digital DVR channels) or qualified analog PSU audio (analog DVR channels).
- 'ICM All' – the MSU speaker unmutes to all PSU audio

## Primary / Secondary Operation Basics

The DVRS has a built-in simulcast prevention mechanism, which prevents more than one DVRS to transmit on the same frequency, at the same time, in the same location.

### **NOTE:**

The algorithm is intended to operate in stationary, same scene scenarios only. It cannot be applied to moving vehicles. **Moving vehicles must either have the DVRS switched OFF or 'VR Disabled' MSU mode selected.**

The DVRs are capable of communicating with each other and negotiating which DVR is a Primary, i.e. elected to repeat, and which DVRs are on Secondary for as long as there is a Primary.

The simulcast prevention algorithm has two phases:

- Primary / Secondary Phase
- Busy Lockout Phase

During the 'Primary / Secondary' phase, the DVRs exchange P25 messages on their Rx frequency. When a DVR is activated (switched to System or Local mode), it sends a query – "Is there a Primary?" If it receives a Primary (or Permanent Primary) 'Heart Beat', then the DVR assumes Secondary state. If no Primary Heart Beat is received, the DVR becomes the Primary and starts sending 'Primary Heart Beats' notifying other DVRs of its status.

The 'Secondary' DVRs monitor any DVR-related activity while in a Standby mode and execute Primary/Secondary checks periodically.

The 'Primary' DVR services any communication requests in the area and 'communicates' its status to the other DVRs periodically.




The Busy Lockout phase serves as an added protection by forcing the Primary DVR not only to periodically communicate with the other DVRs in the area (using its Rx frequency) but also to check for any activity on its Tx frequency prior to every repeat. In order to accommodate the dynamically changing "real life" environment, i.e. DVRs arriving or leaving the scene at random time, DVR channel / mode changes, Permanent Primary activation, Remote DVR steering, etc., the Primary / Secondary algorithm has several built-in layers, configurable in the DVR programmed personality.

The '**Permanent Primary Status Enable**' field (in the **Primary/Secondary Setup** Menu) is disabled by default and should be used only in special applications such as at remote, fixed DVR installations, during testing or by selected public safety personnel.

The Primary / Secondary Status of a DVR is re-evaluated every time one of the following takes place:

- Change of DVR channel frequency
- Change of DVR mode
- Remote activation of another DVR
- Selecting a DVR Disabled TG / Channel on the MSU
- Powering down a DVRS

- Detected presence or absence of another Primary
- User enforced Permanent Primary status

	PRIMARY	STANDBY	PERMANENT PRIMARY
<b>DEFINITION</b>	An active DVR which has won the voting selection and has been selected to repeat Local PSU or System communications.	An active DVR which was voted off and forced to stay on stand-by, without repeating for as long as the elected Primary DVR is servicing the communication needs in the area.	An active DVR, which is forced by the user or programmed to act as a Primary. The Permanent Primary forces all other DVRs in the area to assume Secondary status. If more than one Permanent Primary is available in the same area, it will go through higher level voting to elect one winning Permanent Primary.
<b>SELECTION</b>	Transparent to the user selection via DVRS voting algorithm.	Transparent to the user selection via DVRS voting algorithm.	Press the <b>DVRS</b> button to enter the 'DVR Control Menu', then press the <b>PM</b> button to toggle Permanent Primary Status ON and OFF if such selection is enabled in the DVRS personality.
<b>DISPLAY</b>	<b>Steady</b> 	<b>Flashing</b> 	<b>Steady</b> 

**Table 10 Primary DVR Definitions**

**NOTE:**

As an option, an external light may be placed on the top of the vehicle, which can be used to indicate which DVRS is the currently selected Primary.



### ***Permanent Primary Activation***

If programmed, a DVRS can be forced to be a Permanent Primary from the MSU CH.

#### **NOTE:**

If another Permanent Primary is already present, the newly activated Permanent Primary DVR will force the “old” Permanent Primary to assume Permanent Primary ‘On Standby’ Status. If the Permanent Primary leaves the scene, the Permanent Primary ‘On Standby’ takes over. If several users try to simultaneously activate several DVRS as Permanent Primaries, the DVRS will go through voting to ensure only one Permanent Primary DVR is selected and all other DVRS are forced to become Permanent Primary ‘On Standby’.

### ***Permanent Primary Deactivation***

The Permanent Primary status of a DVRS can be switched off from the MSU CH.

### ***Legacy Mobexcom II Voting Compatibility Mode***

The voting compatibility mode is applicable to analog DVRS mode only. If Legacy Mobexcom II Voting Compatibility mode is enabled in the DVR, its voting algorithm is compatible with older style analog only Mobexcom II VRs. Enabling this feature allows seamless replacement of old style VRs with the new DVR by supporting the deployment of both types of units in the same fleet during the transition period.

## DVRS Modes of Operation

When a “DVRS Enabled” TG / Channel is selected on the APX MSU control head, the DVR can be switched to one of the following modes – OFF, LOCAL or SYSTEM.

### *OFF Mode*

ACTIVITY	OFF MODE ACTION
Control Head Display	VR OFF <DVR CH Name>
DVRS Button Press	Short high-pitched tone. DVR Control Mode is accessible.
MSU Receiving from System	DVR does not repeat audio received by MSU. MSU Speaker Audio present.
MSU User PTTs the MSU Microphone	MSU Keys up. DVR does not key up.
PSU Activity on DVR channel	DVRS Transmit Function Disabled i.e. No DVR repeat. No Speaker Audio.

Table 11 OFF Mode DVRS Basic Operation

### *SYSTEM Mode*

ACTIVITY	SYSTEM MODE ACTION
Control Head Display	VR SYS <DVR CH Name>
DVRS Active Tones	If programmed, a short high-pitched ‘DVR Enabled’ tone is repeated every few seconds (5-255 sec. programmable) in the MSU Speaker regardless of the Primary / Secondary Status of the DVR.
DVRS Button Press	Short high-pitched tone. DVR Control Mode is accessible.
MSU User PTTs the MSU Microphone	Both DVR and MSU key up. DVR may be programmed not to key up!
MSU Receiving from System	DVR repeats audio received by MSU to PSU Users of the designated DVR Channel. Speaker Audio is present.
PSU Activity on DVR channel	PSU audio is repeated locally by DVRS as well as by the MSU to the System. MSU Speaker Audio is present if In-Car Monitor is enabled in the MSU.

Table 12 SYSTEM Mode DVRS Basic Operation

**NOTE:**

If the selected DVR channel attribute is programmed as Simplex, the local voice repeat DVR function is not available. If proxying and In-Car Monitor are enabled and the TG selected by the local PSU is different from that selected on the MSU, then Inbound or Outbound speaker audio will depend on the MSU ICM setting ('ICM Selected' or 'ICM All') as well as the ICM trigger as described in the **In Car Monitor (ICM)** section of this document.

**LOCAL Mode**

ACTIVITY	LOCAL MODE ACTION
Control Head Display	VR LOC <DVR CH Name>
DVRS Active Tones	If programmed, a short high-pitched 'DVR Enabled' tone is repeated every few seconds (5-255 sec. programmable) in the MSU Speaker regardless of the Primary / Secondary Status of the DVR.
DVRS Button Press	Short high-pitched tone. DVR Control Mode is accessible.
MSU Receiving from System	DVR may be programmed to repeat audio received by MSU to the PSU Users over the DVR Channel when the DVR is idle. Speaker Audio is present.
MSU User PTTs the MSU Microphone	DVR keys up. MSU may or may not key up depending on MSU programming.
PSU Activity on DVR channel	PSU audio is repeated locally by DVRS. Speaker Audio is present if In-Car Monitor is enabled in the MSU.

Table 13 LOCAL Mode DVRS Basic Operation

## Selecting DVRS Mode

When a 'DVRS Enabled' TG / channel is selected on the MSU, the user may enter the 'DVRS Control Mode' by pressing the DVRS button on the control head and change the DVRS mode / channel / status as described below:

### *Selecting DVRS Mode from the Control Head*

To change the DVRS mode:

- Press the **DVRS** button and observe the MSU enter the 'DVR Control Mode'.
- Press the **MODE** button to toggle the DVRS mode until the desired selection appears on the top line of the control mode display.
- Once the desired mode is displayed press the **SEL** button or simply wait for the DVR control mode to timeout (the last selected DVR Mode is in effect).

### *Strapped DVRS Mode*

The DVRS mode and channel may be programmed to be 'Strapped' to the specific MSU TG/Channel.

In this case, selecting a specific MSU TG / channel on the control head would automatically force the DVR to revert to a pre-programmed DVR mode and/or channel.

For example, selecting a DVR Enabled TG named 'DISPATCH' on the MSU may automatically force the DVR to switch to DVR Channel 1, SYSTEM Mode. If enabled in the specific DVR personality programming, the DVRS user can still toggle the DVR mode by pressing the **DVRS** button and entering the 'DVR Control Mode'. If mode change by the user is prohibited in the specific DVRS personality, the user can only select between the 'Strapped' (either LOCAL or SYSTEM) and OFF DVR modes from the 'DVR Control Mode' menu.

## Selecting DVRS Channel

When a 'DVRS Enabled' TG / Channel is selected on the MSU, the user may enter the 'DVRS Control Mode' by pressing the assigned DVRS button on the MSU control head and then change the DVRS mode / channel / status as described below:

### *Independent DVRS Channel Change*

To change the DVRS channel:

- Press the **DVRS** button and observe the display changing to the 'DVR Control Mode' screen with the top line displaying the currently selected DVR mode and channel.
- Use the MSU control head navigation keys to scroll through the available DVR channels. Once the desired DVR channel is selected, press the **SEL** button or wait until the DVR control mode times out.

### *Strapped DVRS Channel Change*

The DVRS mode and channel may be programmed to be strapped to the specific MSU TG/channel. In this case, selecting a specific MSU TG / channel would automatically force the DVR to revert to a given DVR channel and/or mode.

*For example, selecting a DVR Enabled TG named 'DISPATCH' on the O5 may automatically force the DVR to switch to DVR Channel 1, SYSTEM Mode.*

When strapping is enabled and the DVR channel follows the MSU TG/mode selection, the user may still be allowed (if enabled by the DVR programmed personality) to change the DVR channel by pressing the DVRS button and then turning the mode knob.

**NOTE:**

Depending on the specific DVR personality programming, the DVR channel selection may be restricted to a short list of allowed DVR channels (or no channel selection options at all). If channel strapping is enabled then the DVR will always land on the specified strapped DVR channel first even when more than one channels are on its allowed channels list. For example, when TG named 'DISPATCH' is selected on the O5, the DVR automatically lands on DVR CH 1 and the User may be allowed to toggle between DVR Channels 1 and 4 while the selection of DVR channels 2 and 3 may be prohibited.

## MSU Scan

### *Supported MSU Scan Types*

The MSU Scan feature is allowed while the DVRS is active (System or Local Mode) if the MSU Scan type is configured as one of the following:

- Conventional Scan
- Voting Scan
- Multi System Talkgroup Scan
- Priority Monitoring

### *DVR Enabled / Disabled Rules while MSU Scan is enabled*

The Selected DVRS channel settings are used across all MSU scan channels except when the DVRS operation is Disabled for the given MSU channel.

If the Selected MSU channel is programmed as DVR Disabled, the DVR operation will remain disabled even if the MSU scans to a channel which is DVR Enabled.

The DVR will become temporarily disabled if the MSU lands on a channel that is programmed as DVR Disabled. In this scenario the DVR will not handle Outbound calls received by the MSU but will still repeat Inbound PSU calls by reverting the MSU to its selected channel.

### *Outbound Calls (received by MSU from the FNE) with MSU Scan Enabled*

If the MSU is configured to only unmute to a specific TG ID or NAC, only the audio containing the specified TG ID or NAC will be proxied by the DVRS to the PSU.

Individual call signaling (Page, Call Alert, Message, Radio inhibit etc) originating from a secondary (not the MSU selected) channel is not proxied by the DVRS to the PSU. Emergency Alarm / Call originating from a secondary channel are supported through the DVRS.

### *Inbound Calls (received by DVRS from PSU) with MSU Scan Enabled*

MSU Talkback and Designated TX are not supported when a PSU makes a call through the DVRS while the MSU has SCAN enabled. The MSU always moves back from the landed to the selected channel when the PSU initiates a call through the DVRS.

Talkback and Designated TX are supported only for MSU initiated calls.

## MSU ISSI Roaming

The NGI (New Generation Interoperability) feature and DVR feature will be allowed such that a DVR MSU enabled subscriber may also be enabled for InterWACN-Roaming in the subscriber codeplug. When the MSU roams to a foreign System the DVR will display "VR Limited" to indicate to the user the limited functionality available.

When the MSU has roamed to the foreign system, the following features are not supported by the local PSU.

- Private Call
- Telephone Interconnect
- Call Alert
- Dynamic Regrouping
- Radio Check
- Multisystem Scan
- Selector Lock
- Status
- Message
- Remote Monitor
- Reprogram Request
- Radio Inhibit

## Unsupported PSU Features

The following PSU features are not presently supported by the DVRS or DVRS Enabled PSUs:

- Evac Tone
- Hearclear
- DTMF Hot Keypad
- Securenet
- Soft ID
- QCII
- Singletone
- Conventional OTAR
- Authentication Demand packets
- Over-the-Air-Channel Reassignment (OTACR)
- Over-the-Air Channel Steering (OTACS)
- Over-the-Air-Programming (OTAP)
- PSU Scan
- PSU Reprogram request / Selector Lock
- PSU Smart PTT
- PSU Announcement Group operation
- PSU Phase II P25 conventional operation

**NOTE:**

The unsupported PSU features list provided above may NOT include ALL unsupported features. Please contact Motorola Solutions Inc for specific feature support information.



## P25 Digital Mode Operation

This chapter provides details on the DVRS Digital P25 mode of operation.

The P25 Digital mode assumes the following:

- APX MSU Programmed for DVRS Operation
- P25 FDMA/TDMA only mode is selected on the MSU.
- P25 PSU programmed for DVRS operation (Local PSU).
- DVRS Enabled mode selected on the Local PSU.
- DVR channel is programmed in the DVR for Digital (or Mixed) Mode of Operation.

### **NOTE:**

The **Local PSU** notation throughout this chapter refers to a P25 PSU which is used to communicate with / through the DVRS.

'**DVRS Enabled**' type **Local PSU** refers to the models described in **Table 6** when programmed for DVRS operation.

Some of the Digital mode DVRS features described are only available in P25 'DVRS Enabled' type PSUs and not available in Generic P25 PSUs (refer to **Table 6**).

A **System PSU** refers to a P25 PSU which has a P25 Mode (Trunking or Conventional) selected and communicates directly with the P25 Trunking or Conventional System, i.e. without a DVRS.

In in-band DVRS applications, the **Local** and **System PSUs** may be of the same model and personality. When a 'DVR Enabled' P25 Mode is selected, the PSU is referred to as **Local PSU**. When a P25 System TG / Channel is selected, the PSU is referred to as **System PSU**.

In cross-band DVRS applications, the **Local PSUs** operate in different frequency band from the system infrastructure, i.e. from the **System PSUs**.

## PSU Affiliation

When a Local PSU user selects a DVR Enabled TG, the Local PSU is affiliated via an active Primary DVRS if:

- The DVR is programmed for Digital (or Mixed) mode on the selected DVR channel.
- The same Digital DVR channel is selected on both the PSU and the DVRS.

Generic P25 PSU is registered during the first Group Call made after switching to the DVR enabled Mode. 'DVRS Enabled' P25 PSU starts automatic affiliation process upon selection of DVR Enabled Mode (no PTT required to start affiliation process). The maximum number of PSUs that can get affiliated with one DVRS is 256.

## Group Calls

Inbound and Outbound Group Calls are supported by the DVRS.

## MSU Priorities

MSU Proxy Request Priority Level	Proxy Request
LOW	Idle (incl. in Emergency Call, not receiving audio) Group Voice Receive (all group call types, including hang time while on trunked voice channel) Packet Data
MEDIUM	Transmitting Signaling features (call alert, status etc.) Individual Calls (unit to unit and Phone)
HIGH	Emergency Alarm Emergency Call Transmit Emergency Call Receive MSU Mode Change, Power Down

Table 14 MSU Proxy Request Priorities

## PSU Proxy Request Priorities

PSU Proxy Request Priority Level	Proxy Request
HIGH	Emergency Alarm Emergency Call
LOW	All other Proxy Requests

Table 15 PSU Proxy Request Priorities

## Signaling Request Interactions with Voice and Signaling Proxy

When the DVR is in the process of handling a voice or signaling request for a PSU and another Local PSU initiates a Signaling request, the DVRS will respond depending on its programming and as described in **Table 16** and **Table 17** below. PSU Emergency Alarm is considered High Priority Signaling. All other PSU signaling (such as Status, Message etc.) is considered Low Priority.

New Request	Existing Request	Action
High Priority Signaling	High Priority Signaling	Queue New Request
High Priority Signaling	Low Priority Signaling	Process New Request
Low Priority Signaling	Low/High Priority Signaling	Queue New Request

**Table 16 Signaling Request Interaction with Signaling Proxy**

New Request	Existing Request	'Outbound Takeover By Signaling Allowed'	Action
High Priority Signaling	PSU Group Voice	Enabled or Disabled	Process New Request
High Priority Signaling	PSU Individual Voice	Enabled or Disabled	Process New Request
High Priority Signaling	Outbound FNE Group Voice	Enabled or Disabled	Process New Request
High Priority Signaling	Outbound FNE Individual Voice	Enabled or Disabled	Process New Request
Low Priority Signaling	PSU Group Voice	Enabled or Disabled	Discard New Request
Low Priority Signaling	PSU Individual Voice	Enabled or Disabled	Discard New Request
Low Priority Signaling	Outbound FNE Group Voice	Enabled	Process New Request
Low Priority Signaling	Outbound FNE Group Voice	Disabled	Discard New Request
Low Priority Signaling	Outbound FNE Individual Voice	Enabled or Disabled	Discard New Request
H/L Priority Signaling	Group Voice Hangtime	Enabled or Disabled	Process New Request
High Priority Signaling	Individual Voice Hangtime	Enabled or Disabled	Process New Request
Low Priority Signaling	Individual Voice Hangtime	Enabled	Process New Request
Low Priority Signaling	Individual Voice Hangtime	Disabled	Discard New Request

**Table 17 Signaling Request Interaction with Voice Proxy**

## Voice Request Interaction with Signaling and Voice Proxy

Voice Request Interactions with Signaling Proxy are described in **Table 18**. Emergency Call is considered high priority voice, while all group voice calls (including Patch, Dynamic Regrouping and Announcement / Multigroup) are considered low priority voice. PSU Emergency Alarm is considered high priority signaling. All other PSU signaling (such as Status, Message etc.) is considered low priority. Voice Proxy Request Interactions with Voice Proxy are handled by the DVRS as programmed, see **Table 19**.

New Request	Existing Request	Action
High Priority Voice	High/Low Priority Signaling	Process New Request
Low Priority Voice	High Priority Signaling	Discard New Request
Low Priority Voice	Low Priority Signaling	Process New Request

**Table 18** Voice Request Interactions with Signaling Proxy

New Request		Existing Request	'Inbound Takeover Allowed'	'Outbound Takeover by Voice Allowed'	Action*
High Voice	Priority	High Priority PSU Group Voice	Disabled	Enabled or Disabled	Discard New Request
High Voice	Priority	High Priority PSU Group Voice	Enabled	Enabled or Disabled	Process New Request
High Voice	Priority	Low Priority PSU Group Voice	Enabled or Disabled	Enabled or Disabled	Process New Request
High Voice	Priority	PSU Individual Call	Enabled or Disabled	Enabled or Disabled	Process New Request
High Voice	Priority	Outbound H/L Priority FNE Group Voice	Enabled or Disabled	Enabled or Disabled	Process New Request
Low Priority Voice		High Priority PSU Group Voice	Enabled or Disabled	Enabled or Disabled	Discard New Request
Low Priority Voice		Low Priority PSU Group Voice	Enabled	Enabled or Disabled	Process New Request
Low Priority Voice		Low Priority PSU Group Voice	Disabled	Enabled or Disabled	Discard New Request
Low Priority Voice		PSU Individual Voice	Enabled	Enabled or Disabled	Process New Request
Low Priority Voice		PSU Individual Voice	Disabled	Enabled or Disabled	Discard New Request
Low Priority Voice		Outbound H/L Priority FNE Group Voice	Enabled or Disabled	Enabled	Process New Request
Low Priority Voice		Outbound H/L Priority FNE Group Voice	Enabled or Disabled	Disabled	Discard New Request
High/Low Voice	Priority	Group Voice Hangtime	Enabled or Disabled	Enabled or Disabled	Process New Request
Low Priority Voice		Individual Voice Hangtime	Enabled or Disabled	Enabled	Process New Request
Low Priority Voice		Individual Voice Hangtime	Enabled or Disabled	Disabled	Discard New Request

\*Action rules apply to 'DVRS Enabled' PSUs. Generic Conventional P25 radios perform interrupts based on which unit has the strongest signal.

**Table 19 Voice Proxy Interaction with Voice Proxy**

## MSU Voice and Signaling Proxy Interactions

The MSU handles interactions with a PSU voice or signaling proxy request from the DVR based on the following general priority rules:

- MSU Emergency overrides all proxies including PSU emergency alarm / emergency call.
- PSU Emergency overrides all MSU non-emergency proxies
- MSU PTT and signaling features (call alert, status etc) override all PSU non-emergency proxies
- PSU non-emergency proxies override MSU receive

## Talk Group Proxing

The Local PSU User can change the selected 'DVRs Enabled' TG and seamlessly talk to the corresponding TG users through the DVRs. The MSU can be on any 'DVRs Enabled' TG, which may or may not match the TG selected by the Local PSU. For example, if the Local PSU selects TG1 while the MSU is on TG2, the Local PSU can talk to Local TG1 users as well as System TG1 users via the DVRs i.e. the MSU will be transmitting on TG1. If the MSU microphone is PTT-ed, both the MSU and the DVR will transmit on the TG selected on the MSU i.e. TG2. An outbound call received by the MSU on either TG1 or TG2 will be repeated by the DVRs to the Local PSUs.

**If Proxing is Disabled then the Local PSU and the MSU must have the same TG selected in order to enable Local PSU affiliation and communications.**

## Talk Group Translation

When TG translation is enabled in the DVR for a specific PSU TG ID, then any call that is received by the DVR from the Local PSU with this TG ID will be translated to the ID of the TG currently selected on the MSU's control head. The Local PSU could be programmed with just one TG ID and if this ID is programmed in the DVRs TG Translation list, the PSU call will always be translated by the DVRs to the TG ID currently selected on the MSU control head. For instance, if the Local PSU is on TG A, which is programmed in the DVRs TG Translation list and the MSU is on TG B then all inbound Local PSU calls will be repeated by the DVR locally and to the system on TG B. If the MSU mode is then switched to TG C then the Local PSU calls will be repeated on TG C.

Generic (non-DVRs Enabled) Conventional P25 PSUs that are not enabled for talkgroup operation will, by default, use TG ID 1 when transmitting. If TG ID 1 is added to the DVR Translation table then PSUs transmitting TG ID 1 will be translated to the TG selected on the MSU.

### **IMPORTANT!**

**TG Translation requires that TG Proxing is enabled.**

When TG proxing is enabled and the TG selected on the Local PSU is programmed in the DVRs Translation Table, the DVRs will affiliate the Local PSU on the TG that is selected on the MSU. If TG Proxing is enabled but the Local PSU is on a TG that is not in the DVRs TG Translation list then the DVRs will proxy any inbound / outbound calls on the PSU TG ID. Outbound call (system originated call) received on the currently selected MSU TG is repeated 'as is' i.e. without any translation. Therefore the Local PSUs need to be programmed with Normal Squelch (or NID = F7E) in order to hear those calls.

**IMPORTANT!**

**Encryption Key Translation is not supported by the DVRS.**

## Private Calls

Private Calls (Local to Local PSU; Local to System PSU; System to Local PSU) are supported on 'DVRS Enabled' PSUs only. Generic P25 PSU mode does not support Private Calls via DVRS.

## PSU Talk Permit Tones

'Go Ahead' tones are generated in the 'DVRS Enabled' PSUs. Different tones are generated to indicate if the DVRS is in Local or System Mode or the call is P25 Encrypted. As a programming option Local Mode tones can be generated when the System is busy and only Local repeat is available. Alternatively, the PSU user can get 'System Busy' tones and be forced to wait for system grant (see '**Digital System Setup Menu**' in the **DVRS Programming** section). Generic P25 PSU mode does not support Talk Permit Tones when operating through the DVRS.

## Status Broadcast

If enabled in the DVR ("**Network Status Reporting Interval**", Digital System setup screen), the DVR transmits status broadcasts that can be received only by P25 DVRS Enabled PSUs:

- FNE Out of Range
- DVR Local only status
- Site Trunking
- IV&D Data Enabled / Disabled status

**NOTE:**

Only a **Primary** DVR can transmit Status Broadcasts.

The above status indication is not available to Generic P25 PSUs when using the DVRS. The status indication is passed to the Local PSU every time the status changes. If there is no change to the status, the DVRS sends status indication to the Local PSUs at a preprogrammed time interval. The DVRS also sends a network status notification every time a Local PSU is affiliated with the System via DVRS. If the FNE enters Failsoft mode, the MSU proxies the Failsoft message (if Failsoft is enabled in the MSU). The DVR stops sending Status Broadcast to the local DVRS Enabled PSUs and periodically transmits Failsoft message instead.

## Local Mode Indication

When the DVRS is operating in the LOCAL mode, the DVRS Enabled PSU User can see “**LOCAL ONLY**” message displayed on the PSU screen if Status broadcast is enabled in the DVR as described in the ‘Status Broadcast’ paragraph. The above indication is only available on ‘DVRS Enabled’ P25 PSUs and is not available to Generic P25 PSUs.

## Radio Check / Inhibit

Radio Check and Radio Inhibit functions are passed through the DVRS to the Local PSU when the DVRS is in the SYSTEM or LOCAL mode. Those functions are available to both ‘DVRS Enabled’ and Generic P25 PSUs when the MSU is operating on a P25 Trunked or P25 Conventional Mode. If the MSU gets radio inhibited, the DVR switches to ‘VR Disabled’ mode of operation.

## P25 Trunking OTAR

P25 Over The Air Rekeying (OTAR) is supported through the DVRS when the Local PSUs are of the ‘DVRS Enabled’ type, the DVRS is in the SYSTEM mode and the MSU is on a P25 Trunking mode. OTAR is not supported if generic P25 PSUs are used and / or if the MSU is on a P25 conventional channel.

## Patch

When several TGs are patched on the system side (using the trunking group-regrouping function), the DVRS ensures the patching is matched on the local PSU side when ‘DVRS Enabled’ PSUs are used, the DVRS is in the SYSTEM or LOCAL mode and the MSU is on a P25 Trunking TG.

### **IMPORTANT!**

**System design must ensure that PSU TGs that are programmed for TG Translation are outside of the range of talkgroups used on the trunking system.**

MSU Patch is supported as follows:

- Inbound call from PSU on TG Translation enabled TG will be translated to the patch supergroup and repeated locally and to the system.
- Outbound call will be repeated as is (with the supergroup TG ID).



## Dynamic Regrouping

The Dynamic Regrouping feature allows a dispatcher to remotely redirect subscribers to operate on a designated TG without any intervention from the subscriber unit operator. This is done by remotely assigning a new TG for the subscriber to operate on. When the subscriber receives the request, it automatically switches to the assigned zone / channel. The DVRS extends this functionality to the 'DVRS Enabled' Local PSUs when the DVRS is in the SYSTEM or LOCAL mode and the MSU is operating on a P25 trunked channel. PSU Reprogram request (PSU requesting to be dynamically regrouped or ungrouped) and Selector Lock / Unlock (disabling / enabling the zone/channel selection functionality while a PSU is dynamically regrouped) are not presently supported via the DVRS.

### **NOTE:**

Dynamic Regrouping is not supported on Generic P25 PSUs.

## Phone Interconnect

Phone Interconnect is supported on Local P25 'DVRS Enabled' PSU when the DVRS is on a full duplex P25 channel (digital or mixed mode) and the MSU is on a P25 Trunked mode. Phone Interconnect requires the DVR to be in the System or Local mode.

## Adaptive Power Control

The DVRS sends P25 messages to the Local 'DVRS Enabled' PSUs to adjust their transmit power depending on the received signal strength and thereby to conserve the PSU battery. Enabling this feature is NOT recommended in applications where multiple PSUs are used with a single simplex mode DVRS since it will affect the PSU-to-PSU communications range

## Digital Audio Buffering

Audio buffering is supported by the DVRS in order to eliminate loss of messages / parts of messages due to the inherent delays associated with acquiring system access. The Digital Audio Buffer in the DVR is programmable up to 1800ms.

## P25 Encryption

The DVRS transparently passes the P25 encryption algorithms used by the subscriber and fixed network equipment. Even though the DVRS can be programmed to support TG translation, it cannot support encryption key translation. When the DVR is on a P25 Digital channel, inbound digital audio from a Local PSU is handled according to the following table:

Local PSU Call	MSU Secure Strapping	Receiving Local PSUs	Receiving FNE
P25 Clear	Clear or Secure	P25 Clear	P25 Clear
P25 Encrypted	Clear or Secure	P25 Encrypted	P25 Encrypted

**Table 20 Inbound P25 Encryption Rules**

While the DVR is on a Digital channel, outbound digital audio originating from the FNE is handled according to the following table:

Call from FNE	MSU Secure Strapping	Receiving Local PSUs
P25 Clear	Clear or Secure	P25 Clear
P25 Encrypted	Clear or Secure	P25 Encrypted

**Table 21 Outbound P25 Encryption Rules**

While the DVR is on a Digital channel, outbound digital audio originating from the MSU is handled according to the following table:

MSU Mode	MSU Secure Strapping	Receiving Local PSUs
Digital P25	Clear	P25 Clear
Digital P25	Secure	P25 Encrypted

**Table 22 MSU MIC PTT P25 Encryption Rules**

The MSU interfaced to the DVR will unmute to Inbound or Outbound Encrypted P25 calls ONLY if the MSU contains the key used for encryption in its Encryption Key List.

## Remote DVR Activation and Steering by PSU Call Alert (Page)

A P25 PSU may be programmed to send a Call Alert (Page) and preprogrammed Network ID (NID) to a specific DVRS and thereby remotely change:

- DVRS Mode (from OFF or Local to System)
- DVR Status (Secondary / Primary)
- Selected TG / Channel on MSU

### **NOTE:**

Remote change of MSU Mode has no effect on the operation of the rest of the PSUs in the area since the TG Proxing feature allows multiple TG operation. This applies to Mode change within the same system, and when TG Translation is not enabled

The DVRS is addressed by sending a call alert (page) with the specific programmed DVRS' ID.

### **NOTE:**

All DVRS should have unique IDs programmed in the digital mode settings menu if the remote control feature is to be used. If no DVRS ID is programmed, the DVR will assume the ID of the MSU currently interfaced to it. Remote activation and steering are supported when the MSU ID = DVR ID.

The remote DVR status change will not be successful if there is another Permanent Primary already present in the area (see **Table 23**).

The following table illustrates some typical remote steering scenarios:

Local PSU	DVRS A Steering		DVRS B Steering	
	BEFORE	AFTER	BEFORE	AFTER
Call Alert (Page) to:  DVRS A PSU on TG 1	OFF OR LOCAL  SECONDARY  DVR CH 1 MSU TG 1	<b>SYSTEM</b>  <b>PRIMARY</b>  DVR CH 1 MSU TG 1	LOCAL OR SYSTEM  PRIMARY  DVR CH 1 MSU TG 1	<b>LOCAL OR SYSTEM</b>  <b>SECONDARY</b>  <b>DVR CH 1 MSU TG 1</b>
Call Alert (Page) to:  DVRS A PSU on TG 1	OFF OR LOCAL  SECONDARY  DVR CH 1 MSU TG 1	<b>SYSTEM</b>  SECONDARY  DVR CH 1 MSU TG 1	LOCAL OR SYSTEM  PERM. PRIMARY  DVR CH 1 MSU TG 1	<b>LOCAL OR SYSTEM</b>  <b>PERM. PRIMARY</b>  <b>DVR CH 1 MSU TG 1</b>
Call Alert (Page) to:  DVRS A PSU on TG 2	OFF OR LOCAL  SECONDARY  DVR CH 1 MSU TG 1	<b>SYSTEM</b>  <b>PRIMARY</b>  DVR CH 1 <b>MSU TG 2</b>	LOCAL OR SYSTEM  PRIMARY  DVR CH 1 MSU TG 1	<b>LOCAL OR SYSTEM</b>  <b>SECONDARY</b>  <b>DVR CH 1 MSU TG 1</b>
Call Alert (Page) to:  DVRS A PSU on TG 2	OFF OR LOCAL  SECONDARY  DVR CH 1 MSU TG 1	<b>SYSTEM</b>  SECONDARY  DVR CH 1 <b>MSU TG 2</b>	LOCAL OR SYSTEM  PERM. PRIMARY  DVR CH 1 MSU TG 1	<b>LOCAL OR SYSTEM</b>  <b>PERM. PRIMARY</b>  <b>DVR CH 1 MSU TG 1</b>
Call Alert (Page) to:  DVRS A PSU on CONV1	OFF OR LOCAL  SECONDARY  DVR CH 1 MSU TG 1	<b>SYSTEM</b>  <b>PRIMARY</b>  DVR CH 1 <b>MSU CONV1</b>	LOCAL OR SYSTEM  PRIMARY  DVR CH 1 MSU TG 1	<b>LOCAL OR SYSTEM</b>  <b>SECONDARY</b>  <b>DVR CH 1 MSU TG 1</b>
<b>Call Alert (Page) to:</b>  DVRS A PSU on TG1	<b>OFF OR LOCAL</b>  <b>SECONDARY</b>  <b>DVR CH 1 MSU CONV1</b>	<b>SYSTEM</b>  <b>PRIMARY</b>  <b>DVR CH 1 MSU TG 1</b>	<b>LOCAL OR SYSTEM</b>  <b>PRIMARY</b>  <b>DVR CH 1 MSU TG 1</b>	<b>LOCAL OR SYSTEM</b>  <b>SECONDARY</b>  <b>DVR CH 1 MSU TG 1</b>

Table 23 Typical Remote Steering Scenarios

## Emergency in Digital Mode

The 'DVRs Enabled' P25 PSU can be programmed to block the launch of the Emergency feature if the P25 Trunking system is in failsoft mode (when 'Emergency Blocked in Failsoft' is enabled). The 'DVRs Enabled' P25 PSU can be programmed to use the programmed 'Fallback Revert Talkgroup' while in Emergency and when on the Dynamic Talkgroup channel without an assigned dynamic working group.

### *Emergency Alarm*

When an affiliated Local PSU issues an Emergency Alarm, the active Primary DVR will process the Emergency to the system as follows:

- If the '**Portable ID Display**' box (in the DVR **Emergency Mode Setup**) is checked, the local PSU unit ID will be displayed on the MSU control head of the current Primary DVRS.
- The PSU unit ID will also appear on the display of the other local PSUs if they are programmed accordingly.
- During Emergency Call, the unit ID of the local PSU, which has initiated the Emergency Call, may be displayed on the system PSUs / MSUs if those are programmed accordingly.
- The local PSU ID during Emergency may also be displayed on the dispatcher console.
  
- The DVR sends back an Emergency ACK to prevent the PSU from re-sending the Emergency either right after the DVR decodes the Emergency request (if the '**System Acknowledge Type**' on the **Mobile Radio Channel Settings** menu is set to "**VR Ack**") or after FNE ACK has been received (if the '**System Acknowledge Type**' on the **Mobile Radio Channel Settings** menu is set to '**Site Ack**' or '**Console Ack**').
- All Secondary DVRS in the area are monitoring the number of emergencies issued by local PSUs according to the '**Attempts Timeout**' and '**Attempts Counter**' settings programmed in the DVRs **Emergency Mode Setup**. If the number of detected but not serviced Emergency Attempts exceeds the counter, the Secondary DVRS will go through Primary / Secondary voting to select a new Primary to pass the emergency to the System.
- If a DVRS is in the OFF Mode when it receives an Emergency from a local PSU, the DVR will switch to System mode after the '**Attempts Counter**' is exceeded, affiliate the PSU and pass the Emergency to the System.
- If a DVRS is on a 'VR Disabled' Mode and it receives an Emergency from a local PSU with a valid steering NAC then after the '**Attempts Counter**' is exceeded, the DVRS will steer to the corresponding 'VR Enabled' MSU mode, switch to SYSTEM mode, affiliate the PSU and pass the Emergency to the System.

The PSU Emergency attempts counter must be programmed to be equal to the DVRS '**Attempts Counter**' plus 3.

### ***Emergency Call***

Emergency Call operation provides the user with access to a voice resource on a priority basis. The user's Emergency Call has priority over all other types of call traffic.

Upon receipt of an Emergency Call from a local PSU, the DVRS will process the call locally as well proxy the call to the FNE. The DVR also updates its display to indicate the PSUs Emergency Call condition. Upon PSU Cancellation of the Emergency Call, the DVRS will clear its emergency display. The DVRS will also proxy the PSU emergency cancellation to the P25 FNE. Emergency Hot MIC enables automatic emergency voice transmission without having to press the PSU PTT. PSU Emergency Hot Mic is supported only on 'DVRS Enabled' PSUs. Only the 'DVRS Enabled' PSU waits for Emergency Alarm ACK before requesting a voice channel. If Emergency Hot MIC is enabled in Generic P25 PSUs (or 'DVRS Enabled' XTS PSUs with firmware older than R12.00.13), the PSU will send emergency alarm and immediately enter the call phase, which prevents consistent emergency processing. If the MSU interfaced to the DVR is placed in Emergency Call, the DVR will proxy the call to all Local PSUs that are in the DVRS proxy list.

### ***Emergency Revert through DVR***

The DVR can be configured to revert local PSUs that have entered emergency by mode steering the MSU to a preconfigured zone/channel. When the DVRS is programmed for emergency revert and the MSU is not already in Emergency, the DVR steers the MSU to the preprogrammed zone/channel upon receiving an Emergency Alarm / Call from the PSU. When the DVR receives emergency cancellation from the PSU, it steers the MSU back to the original zone / channel, provided the MSU is not in emergency and the user has not manually changed the MSU channel.

### ***Emergency Revert through PSU***

The PSU can be configured to revert to a preprogrammed talkgroup or zone / channel when it enters Emergency. With the Talkgroup revert option, the PSU does not change its mode but rather stays on the currently selected channel and performs all emergency related voice and signaling by using the Revert Talkgroup ID. Talkgroup revert is only supported on the APX 'DVRS' Enabled PSUs.

### ***Emergency operation during TG Translation***

Emergency operation is affected by TG Translation as follows:

- **Inbound Emergency Alarm** received by the DVRS on TG X will be translated and repeated locally on all translated TG IDs that are selected on Local PSUs, which are currently affiliated with the DVRS. The Emergency Alarm is also translated to the ID of the TG selected on the MSU and forwarded to the System.
- **Outbound Emergency Alarm** received by the MSU on the MSU selected TG (TG Y) will be translated and repeated to the local PSUs on all translated TG IDs that are selected on Local, affiliated with the DVRS PSUs.
- **Inbound Emergency Call** on TG X will be translated by the DVRS to the ID of the TG selected on the MSU and will be repeated locally on the translated TG.
- **Outbound Emergency call** received on TG Y selected on the MSU will be repeated by the DVRS to the Local PSUs on TG Y.
- If Emergency Revert is programmed in the local PSU then:
- If the revert TG is on the DVRS TG Translation list, then the Emergency will be translated to the ID of the TG that is selected on the MSU.

- Emergency Alarm will be repeated locally on all Translation enabled TG IDs that are selected on local (affiliated with the DVRS) PSUs.
- If the revert TG is not in the DVRS TG Translation list then the emergency will be proxied and the inbound, outbound and local repeat will be on the new emergency revert TG.
- If the MSU (interfaced to the Primary DVR) is placed in Emergency and programmed to revert in Emergency then a subsequent local PSU emergency will also be translated and declared on the MSU's emergency revert TG.

## Fireground (FG) Signaling

The Fireground deployment consists of a fleet of subscribers communicating with an incident commander position using digital signaling and either analog or digital voice. If Fireground (FG) signaling is enabled in the local PSUs and on the selected full duplex DVRS channel, the DVR repeats locally the FG messages received from the local PSUs to the FG terminal. FG Emergency signaling received from the local PSU can be either repeated locally, sent to the system or both (as programmed in the DVR).

### **NOTE:**

Only 'Generic P25' PSUs support Fireground operation.

## PSU IV&D

The DVRS supports IV&D for only one PSU at any time. The use of PSU IV&D requires P25 'DVRS Enabled' PSUs, a DVR in LOCAL or SYSTEM mode operating on a P25 digital or Forced Analog channel, and MSU operating on a P25 Trunked mode. Voice operation and signaling (such as call alert etc.) initiated from the MSU or PSU take priority over data operation.

## PSU Location Reporting

Location Reporting is supported on 'DVRS Enabled' PSUs when the MSU is operating on a P25 Trunked system. This feature relies on PSU IV&D functionality described above.

## PSU Call Alert

PSU Call Alert is supported via the DVRS when the MSU is operating on a P25 Trunked or P25 Conventional mode and when the PSU is either P25 **DVRS Enabled** or **P25 Generic**.

## PSU Message

The Message feature is supported on all types of P25 PSUs when the MSU is operating on a P25 Conventional mode only.

## PSU Status Update and Status Request

The PSU Status Update & Status Request features are supported on all types of P25 PSUs when the MSU is operating on a P25 Conventional or P25 trunked mode.

## Automatic PSU Revert to Talk Around (TA)

The DVRS Enabled PSU (with firmware R09.00.00 or later) can be programmed to automatically revert to TA if it goes outside of the DVR radio coverage range. The PSU automatically reverts to normal full duplex operation as soon as it re-enters the DVR radio coverage range.

If using a simplex DVRS channel, the simplex PSU can be programmed to automatically revert to TA so that it can transmit even when the PSU is outside of the range of the DVRS. This way, simplex PSU-to-PSU calls will be allowed regardless of the presence or absence of the DVRS.

## PSU Group Services

Pre-requisites for PSU Group Services support via DVRS:

- APX series 'DVRS Enabled' PSUs with Firmware R14.50.00 or later
- P25 Trunked FNE with firmware 7.16 or later
- DVRS with firmware R1.22 / MSU R14.50.00 or later
- DVRS in SYSTEM or LOCAL Mode, Digital Channel Selected
- MSU that DVR is interfaced to receiving Group Services while on P25 Trunked **FDMA** Mode

The following Group Services can be supported by the DVRS:

### *Group Text*

Group text is an unconfirmed message that is sent to all members of a talkgroup. The DVRS passes the Group Text messages to the local PSUs. If the Local 'DVRS Enabled' PSU users want to receive only Group Text Messages sent to the PSU selected Talkgroup, then the PSU must be programmed for 'Selective Squelch' instead of the default 'Normal Squelch'. If programmed for 'Normal Squelch', the Local PSU will receive all Group Text Messages proxied by the DVRS regardless of the Talkgroup currently selected on the PSU.

### **NOTE:**

The above also applies to voice calls in general – if the Local PSU users want their PSUs to only unmute to the PSU selected Talkgroup, then they need to program 'Selective Squelch' in the PSU. If they are using the default 'Normal Squelch' setting, the PSUs will unmute to all calls proxied by the DVRS regardless of the incoming call Talkgroup.



### ***Group Alias Update***

Group Alias update is a message sent to a given Talkgroup while on a voice channel to alert the receiving radio of the transmitting radio's alias/ID configured in the Provisioning Manager on the console. The updated Group Alias data is received by the members of the Talkgroup and their Unified Call List (UCL) is updated. The DVRS passes the Group Alias Update to the local 'DVRS Enabled' PSUs so that their UCLs can get the update even while they are not directly connected to the trunked system but are proxied via the DVRS.

**NOTE:**

The updated Alias will be displayed on the receiving PSU only when the PSU is directly affiliated on the trunking system. When affiliated through the DVRS, the PSU will still display the Unit ID of the transmitting PSU but it will not display the programmed or the updated Alias for that transmitting Unit ID.

**NOTE:**

When the MSU is operating on TDMA mode, the MSU may receive group services but will not proxy those to the DVRS / Local PSUs.

## Digital Mode – Summary of Features

### *Digital DVR Mode with P25 Trunking Mode Selected on MSU*

The operation described below assumes a DVR Digital mode conventional channel and P25 Talk Group are selected on the DVR and MSU respectively.

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on MSU CH	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	No	Yes	Yes
Talk Group Proxing / Translation	No	Yes	Yes
Outbound Group Call	No	Yes	Programmable
Outbound Private Call	No	Yes	Yes
MSU Microphone PTT	Keys up MSU only	As programmed	As programmed
Inbound Group Call	No	Yes	Yes (Local Side)
Inbound Private Call	No	Yes	Yes
Inbound Call Alert	No	Yes	Yes
PSU Talk Permit Tones	No	Yes	Yes
PSU Emergency Alarm & Call	Yes (after activation)	Yes	Yes
PSU Emergency Revert	No	Yes	Yes
PSU Emerg. ID Pass Through	Yes (after activation)	Yes	Yes
PSU Remote DVRS Activation & Steering	Yes – Call Alert	Yes – Call Alert	Yes – Call Alert
Failsoft / Out of Range / Site Trunking Indication on PSU	No	Yes	No
PSU Local Mode Indication	No	No	Yes
DVR Primary / Secondary Voting	No	Yes	Yes
DVR Tones – MSU Speaker	No	Yes	Yes
PSU Radio Check / Inhibit	No	Yes	Yes
PSU Location	No	Yes	Yes
PSU P25 Trunking OTAR	No	Yes	Yes
PSU Patch	No	Yes	Yes
PSU Dynamic Regrouping	No	Yes	Yes
PSU Selector Lock /Unlock	No	No	No
PSU Phone Interconnect	No	Yes (FDX only)	Yes (FDX only)
PSU Adaptive Power Control	No	Yes	Yes
Audio Buffering	No	Yes	Yes
P25 Encryption	No	Yes	Yes
PSU Scan	No	No	No
PSU Announcement Group	No	No	No
PSU Status / Message	No	Status only	Status only
PSU Group Services	No	Yes	Yes
PSU PTT ID	No	Yes	Yes
LOP (Location on PTT)	No	Yes	Yes

**Digital DVR Mode with P25 Conventional Mode Selected on MSU**

The operation described below assumes a DVR digital mode conventional channel and P25 conventional mode are selected on the DVR and MSU respectively.

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on MSU CH	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	No	Yes	Yes
Talk Group Proxing / Translation	No	Yes	Yes
Outbound Group Call	No	Yes	Programmable
Outbound Private Call	No	No	No
MSU Microphone PTT	Keys up MSU only	As programmed	As programmed
Inbound Group Call	No	Yes	Yes (Local Side)
Inbound Private Call	No	No	No
Inbound Call Alert	No	Yes	Yes
PSU Talk Permit Tones	No	Yes	Yes
PSU Emergency Alarm & Call	Yes (after activation)	Yes	Yes
PSU Emergency Revert	Yes (after activation)	Yes	Yes
PSU Emerg. ID Pass Through	Yes (after activation)	Yes	Yes
PSU Remote DVRS Activation & Steering	Yes – Call Alert	Yes – Call Alert	Yes – Call Alert
Failsoft / Out of Range / Site Trunking Indication on PSU	NA	NA	NA
PSU Local Mode Indication	No	No	Yes
DVR Primary / Secondary Voting	No	Yes	Yes
DVR Tones – MSU Speaker	No	Yes	Yes
PSU Radio Check / Inhibit	No	Yes	Yes
PSU LOCATION	No	Yes	Yes
PSU P25 Trunking OTAR	NA	NA	NA
PSU Patch	NA	NA	NA
PSU Dynamic Regrouping	NA	NA	NA
PSU Selector Lock /Unlock	NA	NA	NA
PSU Phone Interconnect	NA	NA	NA
PSU Adaptive Power Control	No	Yes	Yes
Audio Buffering	No	Yes	Yes
PSU Scan	No	No	No
PSU Announcement Group	No	No	No
P25 Encryption	No	Yes	Yes
PSU Status / Message	No	Yes	Yes
PSU PTT ID	No	Yes	Yes

## Forced Analog Mode

Forced Analog Mode is a hybrid mode in which the communications between the DVRS and the 'DVRS Enabled' P25 PSU are P25 digital, while the voice communications are 'forced' to be analog when the MSU is on a non-P25 channel / Talkgroup. Forced analog mode is used only when the Local PSUs are 'DVRS Enabled'. When the MSU is on analog conventional or 3600 Baud trunking (analog or digital) or P25 TDMA channel the DVR 'forces' the 'DVRS Enabled' PSU to transmit analog voice. When the MSU is on a P25 channel / talkgroup, the DVRS and PSU operate in P25 digital mode. At all times the signaling between the DVRS Enabled PSUs and the DVRS is digital P25. The DVRS must be on a DVR channel programmed for 'F.Analog' mode as described in the '**Repeater Channel Setup Menu**' section.

### **IMPORTANT!**

**Generic P25 PSUs cannot operate with a DVRS in Forced Analog Mode.**

### **IMPORTANT!**

**The PSU and DVR PL/DPLs must be programmed to be properly matched. The DVRS Enabled PSU must be programmed for mixed receive in order to be able to program PL on a 'DVRS Enabled' channel.**

## Forced Analog All DVR Mode- Operation and Programming Overview

Forced Analog All Mode is a hybrid mode in which the communications between the DVRS and the 'DVRS Enabled' P25 PSU are P25 digital, while the voice communications are 'forced' to be analog for all MSU channels. At all times the signaling between the DVRS Enabled PSUs and the DVRS is digital P25. The DVRS must be on a DVR channel programmed for 'F.Analog All' mode as described in the '**Repeater Channel Setup Menu**' section.

### **IMPORTANT!**

**Generic P25 PSUs cannot operate with a DVRS in Forced Analog All Mode.**

### **IMPORTANT!**

**The PSU and DVR PL/DPLs must be programmed to be properly matched. The DVRS Enabled PSU must be programmed for mixed receive in order to be able to program PL on a 'DVRS Enabled' channel.**

## Forced Analog Mode – Summary of Features

### *Forced Analog DVR Mode with Conventional Analog Mode Selected on MSU*

The operation described below assumes a DVR forced analog mode conventional channel and conventional analog mode are selected on the DVR and MSU respectively.

**This mode is supported on 'DVRs Enabled' PSUs ONLY.**

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRs Status Display on the MSU CH	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	No	No	No
Talk Group Proxing	No	No	No
Outbound Group Call	No	Yes	Programmable
Outbound Private Call	No	No	No
MSU Microphone PTT	Keys up MSU only	As programmed	As programmed
Inbound Group Call	No	Yes	Yes (Local Side)
Inbound Private Call	No	No	No
Inbound Call Alert	No	No	Yes (Local Side)
PSU Talk Permit Tones	No	Yes	Yes
PSU Emergency Alarm	Yes (after activation)	Yes	Yes
PSU Emergency Revert via DVRs	No	Yes	Yes
PSU Emerg. ID Pass Through	No	Yes	Yes
PSU Remote DVRs Activation & Steering	Yes – Call Alert	Yes – Call Alert	Yes – Call Alert
Failsoft / Out of Range / Site Trunking Indication on PSU	NA	NA	NA
PSU Local Mode Indication	No	No	Yes
DVR Primary / Secondary Voting	No	Yes	Yes
DVR Tones – MSU Speaker	No	Yes	Yes
PSU Radio Check / Inhibit	No	No	No
PSU LOCATION	No	Yes	Yes
PSU P25 Trunking OTAR	NA	NA	NA
PSU Patch	NA	NA	NA
PSU Dynamic Regrouping	NA	NA	NA
PSU Selector Lock / Unlock	NA	NA	NA
PSU Phone Interconnect	NA	NA	NA
PSU Adaptive Power Control	No	No	No
Audio Buffering	No	Yes	Yes
PSU Scan	No	No	No
PSU Announcement Group	No	No	No
P25 Encryption	No	Programmable	Programmable
PSU Status / Message	No	Yes	Yes
PSU PTT ID	No	Locally only	Locally only

***Forced Analog DVR Mode with 3600 Trunking Mode Selected on MSU***

The operation described below assumes a DVR forced analog mode conventional channel and 3600 Baud trunking analog or digital mode are selected on the DVR and MSU respectively.

**This mode is supported on 'DVRs Enabled' PSUs only.**

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRs Status Display on the MSU CH	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	No	No	No
Talk Group Proxing	No	No	No
Outbound Group Call	No	Yes	Programmable
Outbound Private Call	No	No	No
MSU Microphone PTT	Keys up MSU only	As programmed	As programmed
Inbound Group Call	No	Yes	Yes (Local Side)
Inbound Private Call	No	No	No
Inbound Call Alert	No	No	Yes (Local Side)
PSU Talk Permit Tones	No	Yes	Yes
PSU Emergency Alarm	Yes (after activation)	Yes	Yes
PSU Emergency Call	No	Yes (group call)	Yes (group call)
PSU Emergency Revert via DVRs	No	Yes	Yes
PSU Emerg. ID Pass Through	Yes (after activation)	Yes (with Emergency Alarm)	Yes (with Emergency Alarm)
PSU Remote DVRs Activation & Steering	Yes – Call Alert	Yes – Call Alert	Yes – Call Alert
Failsoft / Out of Range / Site Trunking Indication on PSU	No	No	No
PSU Local Mode Indication	No	No	Yes
DVR Primary / Secondary Voting	No	Yes	Yes
DVR Tones – MSU Speaker	No	Yes	Yes
PSU Radio Check /Inhibit	No	No	No
PSU LOCATION	No	No	No
PSU P25 Trunking OTAR	NA	NA	NA
PSU Patch	No	No	No
PSU Dynamic Regrouping	No	No	No
PSU Selector Lock / Unlock	No	No	No
PSU Phone Interconnect	No	No	No
PSU Adaptive Power Control	No	No	No
Audio Buffering	No	Yes	Yes
PSU Scan	No	No	No
PSU Announcement Group	No	No	No
P25 Encryption	No	No	Programmable
PSU Status / Message	No	No	No
PSU PTT ID	No	Locally only	Locally only

***Forced Analog DVR Mode with P25 Trunking TDMA Mode Selected on MSU***

The operation described below assumes a DVR forced analog mode conventional channel and P25 Phase II (TDMA) 9600 Baud trunking mode are selected on the DVR and MSU respectively.

**This mode is supported on 'DVRs Enabled' PSUs only.**

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRs Status Display on MSU CH	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	No	Yes	Yes
Talk Group Proxing	No	No	No
Outbound Group Call	No	Yes	Programmable
Outbound Private Call	No	No	No
MSU Microphone PTT	Keys up MSU only	As programmed	As programmed
Inbound Group Call	No	Yes	Yes (Local Side)
Inbound Private Call	No	No	No
Inbound Call Alert	No	Yes	Yes
PSU Talk Permit Tones	No	Yes	Yes
PSU Emergency Alarm	Yes (after activation)	Yes	Yes
PSU Emergency Call	No	Yes (group call)	Yes (group call)
PSU Emergency Revert via DVRs	No	Yes	Yes
PSU Emergency ID Pass Through	Yes (after activation)	Yes	Yes
PSU Remote DVRs Activation	Yes (Call Alert)	NA	Yes (Call Alert)
MSU Mode Steering	No	Yes (Call Alert)	Yes (Call Alert)
Failsoft / Out of Range / Site Trunking Indication on PSU	No	Yes	Yes
PSU Local Mode Indication	No	Yes	Yes
DVR Primary / Secondary Voting	No	Yes	Yes
DVR Tones – MSU Speaker	No	Yes	Yes
PSU Radio Check / Inhibit	No	Yes	Yes
PSU LOCATION	No	Yes	Yes
PSU P25 Trunking OTAR	NA	Yes	Yes
PSU Patch	No	Yes	Yes
PSU Dynamic Regrouping	No	Yes	Yes
PSU Selector Lock /Unlock	No	No	No
PSU Phone Interconnect	No	Yes	Yes
PSU Adaptive Power Control	No	Yes	Yes
Audio Buffering	No	Yes	Yes
PSU Scan	No	No	No
PSU Announcement Group	No	No	No
P25 Encryption	No	Yes	Yes
PSU Status / Message	No	Yes	Yes
PSU PTT ID	No	Yes	Yes

## Analog Mode Operation

This Chapter provides details on the DVRS Analog Mode of operation.

The Analog Mode assumes the following:

- APX MSU Programmed for DVRS Operation.
- PSU programmed for DVRS operation using a Conventional, Analog, non-ASTRO Personality.
- DVR Channel used is programmed for Analog (or Mixed) Mode of Operation.

### **NOTE:**

The basic principles of DVRS operation (both Analog and Digital) are as described in the **DVRS Operation Basics** Chapter. This Chapter focuses on features specific to the Analog Mode of operation.

## DVR Channel Setup for Analog Mode

To enable Analog DVR operation on a specific DVR channel the Channel Type (in the Repeater Channel Setup Menu) must be set to **Analog**. The DVR Tx / Rx Frequencies as well as the Tx / Rx PL or DPL must be programmed to match the corresponding PSU settings.

### **NOTE:**

Mixed DVR mode allows Analog DVR operation by switching between digital and analog modes as described in the Mixed DVRS Mode section. The use of mixed mode for analog DVRS communications is not recommended since it requires special user training in order to handle the switching between default digital and temporary analog mode. Mixed DVR mode should only be used when both analog and digital PSUs are required to operate on the same DVR channel.

## Group Calls

An analog local PSU in DVRS mode can communicate with other analog local PSUs via an active Primary DVRS if all units are using the same radio channel (full duplex only) and using matching PL / DPLs. Inbound PSU calls will be repeated on the MSU side over the currently selected MSU TG / Channel. Outbound calls received by the MSU are repeated to the Local Analog PSUs.



## Emergency in Analog Mode

The Emergency operation in analog mode is based on the type of signaling as selected in the Emergency Mode Setup Menu. The recommended analog mode signaling type is MDC1200. Note that in addition to the DVR programming, MDC1200 signaling must also be enabled in the local PSU personality. If MDC 1200 signaling is used, the Local PSU Emergency Alarm MDC ID will be passed through to the system provided the MDC ID is enabled (valid) on the system side.

### **NOTE:**

MDC PTT ID pass-through is not supported by DVRS on Type 2 trunking MSU modes. Only MDC Emergency ID (with Emergency Alarm) pass-through is supported by the DVRS on Type 2 trunking MSU modes.

### *Emergency Alarm*

When an affiliated local PSU issues an Emergency Alarm, the active Primary DVR will process the emergency to the system as follows:

- If the '**Portable ID Display**' box (in the DVR **Emergency Mode Setup**) is checked, the Local PSU Unit ID will be displayed on the MSU control head of the current Primary DVRS.
- The PSU Unit ID will also appear on the display of the other local PSUs if they are programmed accordingly.
- The local PSU ID during Emergency may also be displayed on the dispatcher console.
- The DVR sends back an Emergency ACK to prevent the PSU from re-sending the Emergency either right after the DVR decodes the Emergency request (if the '**System Acknowledge Type**' on the **Mobile Radio Channel Settings** menu is set to "VR Ack") or after FNE ACK has been received (if the '**System Acknowledge Type**' on the **Mobile Radio Channel Settings** menu is set to '**Site Ack**' or '**Console Ack**').
- All Secondary DVRS in the area are monitoring the number of emergencies issued by local PSUs according to the '**Attempts Timeout**' and '**Attempts Counter**' settings programmed in the DVRS **Emergency Mode Setup**. If the number of detected not serviced Emergency Attempts exceeds the counter, the Secondary DVRS will go through Primary / Secondary voting to select a new Primary to pass the emergency to the system.
- If a DVRS is in the OFF mode when it receives an Emergency from a local PSU, the DVR will switch to SYSTEM mode after the '**Attempts Counter**' is exceeded, affiliate the PSU and pass the Emergency to the system.

The PSU Emergency attempts counter must be programmed to be equal to the DVRS '**Attempts Counter**' plus 3.

### *Emergency Call*

Emergency Call operation provides the user with access to a voice resource on a priority basis. The user's Emergency Call has priority over all other types of call traffic. Upon receipt of an Emergency Call from a local PSU, the DVRS will process the call locally as

well as proxy the call to the FNE. On Type II trunking systems, the PSU Emergency Call will be proxied with the **MSU Emergency ID**, NOT the PSU MDC ID. The DVR also updates its display to indicate the PSUs Emergency Call condition.

### ***Emergency Revert through DVR***

The DVR can be configured to revert the local PSUs that have entered emergency by mode steering the MSU to a preconfigured zone/channel. When the DVRS is programmed for emergency revert and the MSU is not already in Emergency, the DVR steers the MSU to the preprogrammed zone/channel upon receiving and Emergency Alarm / Call from the PSU. The emergency revert condition can be configured as permanent or timed. If configured as timed then the DVR will revert the MSU back to the original channel after the emergency inactivity timer expires without inbound or outbound activity.

### **Analog Audio Buffering**

Audio buffering is supported by the DVRS in order to eliminate loss of messages / parts of messages due to the inherent delays associated with acquiring system access. The analog buffer is programmable in the DVR (up to 1300ms).

### **Tactical Public Safety (TPS)**

The TPS feature allows analog subscribers to send digital PTT ID information on an analog channel with analog voice. TPS is only supported when the DVR is on an analog channel in the SYSTEM mode and the MSU is configured for analog transmit (without any signaling) and with Mixed receive.

### **Fireground (FG) Signaling**

The Fireground deployment consists of a fleet of subscribers communicating with an incident commander position using digital signaling and either analog or digital voice.

If Fireground (FG) signaling is enabled in the local PSUs and on the selected full duplex DVRS channel, the DVR repeats locally the FG messages received from the Local PSUs to the FG terminal.

FG Emergency signaling received from the Local PSU can be either repeated locally, sent to the system or both (as programmed in the DVR).

#### **NOTE:**

Only Generic P25 PSUs support Fireground operation.

## Remote DVRS Activation via DTMF

The local PSU may be programmed to remotely activate the DVR by switching it from OFF or LOCAL to SYSTEM mode by sending a pre-programmed DTMF sequence. The remote activation only works if the Local PSU and the DVR are set to operate on the same radio channel and there is no other Primary / Permanent Primary DVR in the area operating on the same channel.

### **IMPORTANT!**

**The DVR cannot be switched OFF remotely via DTMF.**

## P25 Encryption in Analog Mode

If the MSU is receiving a P25 Encrypted call while the DVRS is operating on analog channel, the DVRS can be programmed to do one of the following:

- Forward encrypted audio to the local PSUs
- Forward clear audio to the local PSUs
- Send warning tones to the local PSUs and no audio

P25 Encrypted audio received by the MSU is processed by the DVRS as described below:

Call from FNE received by MSU	DVR Programming for Outbound Encrypted Calls	DVR Transmits to receiving Local PSUs
P25 Encrypted	Transmit Encrypted	P25 Encrypted*
P25 Encrypted	Transmit Clear	Clear Analog
P25 Encrypted	Send Warning Tones	Warning Tones

*\*Local PSUs must be configured for Mixed receive.*

## Leading & Trailing Tones

The DVR can be programmed to send over-the-air Leading or Trailing tones to the LPSUs to indicate successful MSU key up / system access.

If Leading Tones are enabled, the local PSU operation involves the following:

- User does a quick PTT of LPSU so that MSU can request channel grant
- User releases the PTT for a moment and waits to hear the Leading tones.
- If the Leading tones indicate successful system access (channel grant), the LPSU user PTTs again and talks.
- If the Leading tones indicate lack of channel grant, the LPSU user can try the call again.

Trailing tones are sent at the end of LPSU transmission and therefore do not require double PTT.

Both Leading and Trailing Tones are sent over-the-air (i.e. not generated in the PSU that initiates the call) therefore all LPSUs that are within the DVR range and switch to the DVR channel will hear the tones.

## Mobile Mode Steering via PL/DPL

This feature allows a PSU User to remotely change the currently selected MSU mode by transmitting with a pre-programmed PL/DPL. When the DVR decodes the PL/DPL it finds the corresponding MSU mode in its look-up table and steers the MSU to the new mode. Depending on the programming, the MSU may either stay on the new mode or it may revert after a preprogrammed timer expires to the originally selected MSU mode. The preprogrammed timer (**'MSU Mode Steering Hang Time'**, **Analog Setup**) starts after the local PSU (causing the steering) keys off.

### *Steering and Emergency*

- If steering is disabled on the current DVR channel, local PSU emergency is declared on the currently selected MSU channel (no steering).
- If steering is enabled on the current DVR channel, the local PSU emergency is declared on the new (steered) MSU mode.
- When MSU is in emergency call state (**'Put DVR in Emergency Call State'** is enabled), the local PSU calls handling is defined by the **'Steering in Emergency'** programming for the specific DVR channel. If **'Steering in Emergency'** is Disabled, the DVR repeats any local PSU calls on the emergency channel (no steering occurs).
- If **'Steering in Emergency'** is enabled, the DVR will steer and then key up the MSU. In this case the MSU will re-declare Emergency call on the new (steered to) channel.
- If **'Put DVR in Emergency Call State'** is Disabled (local PSU and MSU programmed for Emergency Alarm only), an inbound local PSU call initiated while the MSU is waiting for emergency ACK, should terminate MSU emergency and steer the MSU to the corresponding MSU mode/channel without re-declaring the emergency alarm on the new MSU channel.

## MSU Operating on TDMA (P25, Phase 2)

When the MSU is switched to a TDMA capable mode, the DVR can operate in either Analog, Forced Analog, Forced Analog All or Digital mode.

For Forced Analog & Forced Analog All mode operation, please refer to the **Forced Analog & Forced Analog All Mode** section of this document.

When operating on TDMA system, any TDMA specific feature that can cause the MSU to interrupt an ongoing transmission will also affect the proxying of Local PSU transmissions to the system. The Local PSU will not receive an indication that its proxy transmission from the MSU to the system may have gotten interrupted.

## Analog Mode – Summary of Features

### *Analog DVR Mode with P25 Trunking Mode Selected on MSU*

The operation described below assumes a DVR analog mode channel and P25 Talk Group are selected on the DVR and MSU respectively.

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on MSU CH	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	No	No	No
Talk Group Proxing	No	No	No
Outbound Group Call	No	Yes	Programmable
Outbound Private Call	No	No	No
MSU Microphone PTT	Keys up MSU only	As programmed	As programmed
Inbound Group Call	No	Yes	Yes (Local Side)
Inbound Private Call	No	No	No
Inbound Call Alert	No	No	No
PSU Leading/Trailing Tones	No	As Programmed	As Programmed
PSU Emergency Alarm	Yes (after activation)	Yes	Yes
PSU Emergency Call	No	Yes (group call)	Yes (group call)
PSU Emergency Revert via DVRS	Yes (after activation)	Yes	Yes
PSU Emerg. ID Pass Through	Yes (after activation)	Yes – MDC1200 with Emerg. Alarm	Yes – MDC1200 with Emerg. Alarm
PSU Remote DVRS Activation	Yes – DTMF	NA	Yes – DTMF
MSU Mode Steering	No	Yes (PL/DPL)	Yes (PL/DPL)
Failsoft / Out of Range / Site Trunking Indication on PSU	No	No	No
PSU Local Mode Indication	No	No	No
DVR Primary / Secondary Voting	No	Yes	Yes
DVR Tones – MSU Speaker	No	Yes	Yes
PSU Radio Check / Inhibit	No	No	No
PSU LOCATION	No	No	No
PSU P25 Trunking OTAR	No	No	No
PSU Patch	No	No	No
PSU Dynamic Regrouping	No	No	No
PSU Selector Lock /Unlock	No	No	No
PSU Phone Interconnect	No	No	No
PSU Adaptive Power Control	No	No	No
Audio Buffering	No	Yes	Yes
PSU Scan	No	No	No
PSU Announcement Group	No	No	No
P25 Encryption	No	Programmable	Programmable
PSU Status / Message	No	Yes Status only	Yes Status only
PSU PTT ID	No	Yes	Yes

**Analog DVR Mode with P25 Conventional Mode Selected on MSU**

The operation described below assumes a DVR analog mode channel and conventional P25 channel are selected on the DVR and MSU respectively.

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on MSU CH	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	No	No	No
Talk Group Proxing	No	No	No
Outbound Group Call	No	Yes	Programmable
Outbound Private Call	No	No	No
MSU Microphone PTT	Keys up MSU only	As programmed	As programmed
Inbound Group Call	No	Yes	Yes (Local Side)
Inbound Private Call	No	No	No
Inbound Call Alert	No	No	No
PSU Leading / Trailing Tones	No	Yes	Yes
PSU Emergency Alarm	Yes (after activation)	Yes	Yes
PSU Emergency Revert	No	Yes	Yes
PSU Emerg. ID Pass Through	Yes (after activation)	Yes – MDC1200 with Emerg. Alarm	Yes – MDC1200 with Emerg. Alarm
MSU Mode Steering	No	Yes (PL/DPL)	Yes (PL/DPL)
Failsoft / Out of Range / Site Trunking Indication on PSU	NA	NA	NA
PSU Local Mode Indication	No	No	No
DVR Primary / Secondary Voting	No	Yes	Yes
DVR Tones – MSU Speaker	No	Yes	Yes
PSU Radio Check / Inhibit	No	No	No
PSU LOCATION	No	No	No
PSU P25 Trunking OTAR	NA	NA	NA
PSU Patch	NA	NA	NA
PSU Dynamic Regrouping	NA	NA	NA
PSU Selector Lock /Unlock	NA	NA	NA
PSU Phone Interconnect	No	No	No
PSU Adaptive Power Control	No	No	No
Audio Buffering	No	Yes	Yes
PSU Scan	No	No	No
PSU Announcement Group	No	No	No
P25 Encryption	No	Programmable	Programmable
PSU Status / Message	No	Yes	Yes
PSU PTT ID	No	Yes	Yes

***Analog DVR Mode with Conventional Analog Mode Selected on MSU***

The operation described below assumes a DVR analog mode channel and conventional analog channel are selected on the DVR and MSU respectively.

<b>FEATURE</b>	<b>DVR OFF Mode</b>	<b>DVR SYSTEM Mode</b>	<b>DVR LOCAL Mode</b>
<b>DVRS Status Display on MSU CH</b>	<b>VR OFF &lt;DVR CH&gt;</b>	<b>VR SYS &lt;DVR CH&gt;</b>	<b>VR LOC &lt;DVR CH&gt;</b>
<b>PSU Affiliation</b>	No	No	No
<b>Talk Group Proxing</b>	No	No	No
<b>Outbound Group Call</b>	No	Yes	Programmable
<b>Outbound Private Call</b>	No	No	No
<b>MSU Microphone PTT</b>	Keys up MSU only	As programmed	As programmed
<b>Inbound Group Call</b>	No	Yes	Yes (Local Side)
<b>Inbound Private Call</b>	NA	NA	NA
<b>Inbound Call Alert</b>	No	No	No
<b>PSU Leading / Trailing Tones</b>	No	Yes	Yes
<b>PSU Emergency Alarm</b>	Yes (after activation)	Yes	Yes
<b>PSU Emergency Revert via DVRS</b>	No	Yes	Yes
<b>PSU Emerg. ID Pass Through</b>	Yes (after activation)	Yes	Yes
<b>PSU Remote DVRS Activation</b>	Yes – DTMF	NA	Yes – DTMF
<b>MSU Mode Steering</b>	No	Yes (PL/DPL)	Yes (PL/DPL)
<b>Failsoft / Out of Range / Site Trunking Indication on PSU</b>	NA	NA	NA
<b>Local Mode Indication on PSU</b>	No	No	No
<b>DVR Primary / Secondary Voting</b>	Yes	Yes	Yes
<b>DVR Tones – MSU Speaker</b>	No	Yes	Yes
<b>PSU Radio Check / Inhibit</b>	No	No	No
<b>PSU LOCATION</b>	No	No	No
<b>P25 Trunking OTAR</b>	NA	NA	NA
<b>PSU Patch</b>	NA	NA	NA
<b>PSU Dynamic Regrouping</b>	NA	NA	NA
<b>PSU Selector Lock / Unlock</b>	NA	NA	NA
<b>PSU Phone Interconnect</b>	NA	NA	NA
<b>PSU Adaptive Power Control</b>	NA	NA	NA
<b>Audio Buffering</b>	No	Yes	Yes
<b>PSU Scan</b>	No	No	No
<b>PSU Announcement Group</b>	No	No	No
<b>P25 Encryption</b>	No	No	Programmable
<b>PSU Status / Message</b>	No	Yes	Yes
<b>PSU PTT ID</b>	No	Yes	Yes

**Analog DVR Mode with 3600 Baud Analog or Digital Trunking Mode Selected on MSU**

The operation described below assumes a DVR analog mode channel and 3600 Baud analog or digital trunking mode are selected on the DVR and MSU respectively.

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on MSU CH	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	No	No	No
Talk Group Proxing	No	No	No
Outbound Group Call	No	Yes	Programmable
Outbound Private Call	No	No	No
MSU Microphone PTT	Keys up MSU only	As programmed	As programmed
Inbound Group Call	No	Yes	Yes (Local Side)
Inbound Private Call	No	No	No
Inbound Call Alert	No	No	No
PSU Leading / Trailing Tones	No	Yes	Yes
PSU Emergency Alarm	Yes (after activation)	Yes	Yes
PSU Emergency Call	No	Yes (group call, using MSU unit ID and TG)	Yes (group call, using MSU unit ID and TG)
PSU Emergency Revert via DVRS	No	Yes	Yes
PSU Emerg. ID Pass Through	Yes (after activation)	Yes – MDC1200 with Emerg. Alarm	Yes – MDC1200 with Emerg. Alarm
PSU Remote DVRS Activation	Yes – DTMF	NA	Yes – DTMF
MSU Mode Steering	No	Yes (PL/DPL)	Yes (PL/DPL)
Failsoft / Out of Range / Site Trunking Indication on PSU	No	No	No
PSU Local Mode Indication	No	No	No
DVR Primary / Secondary Voting	No	Yes	Yes
DVR Tones – MSU Speaker	No	Yes	Yes
PSU Radio Check / Inhibit	No	No	No
PSU LOCATION	No	No	No
PSU P25 Trunking OTAR	NA	NA	NA
PSU Patch	No	No	No
PSU Dynamic Regrouping	No	No	No
PSU Selector Lock /Unlock	No	No	No
PSU Phone Interconnect	No	No	No
PSU Adaptive Power Control	No	No	No
Audio Buffering	No	Yes	Yes
PSU Scan	No	No	No
PSU Announcement Group	No	No	No
P25 Encryption	No	No	Programmable
PSU Status / Message	No	No	No
PSU PTT ID	No	No	No



**Analog DVR Mode with P25 Phase II (TDMA) Trunking Mode Selected on MSU**

The operation described below assumes a DVR analog mode channel and Phase II TDMA 9600 Baud trunking mode are selected on the DVR and MSU respectively.

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on MSU CH	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	No	No	No
Talk Group Proxing	No	No	No
Outbound Group Call	No	Yes	Programmable
Outbound Private Call	No	No	No
MSU Microphone PTT	Keys up MSU only	As programmed	As programmed
Inbound Group Call	No	Yes	Yes (Local Side)
Inbound Private Call	No	No	No
Inbound Call Alert	No	No	No
PSU Leading / Trailing Tones	No	Yes	Yes
PSU Emergency Alarm	Yes (after activation)	Yes	Yes
PSU Emergency Call	No	Yes (group call)	Yes (group call)
PSU Emergency Revert via DVRS	No	Yes	Yes
PSU Emerg. ID Pass Through	Yes (after activation)	Yes – MDC1200 with Emerg. Alarm	Yes – MDC1200 with Emerg. Alarm
PSU Remote DVRS Activation	Yes – DTMF	NA	Yes – DTMF
MSU Mode Steering	No	Yes (PL/DPL)	Yes (PL/DPL)
Failsoft / Out of Range / Site Trunking Indication on PSU	No	No	No
PSU Local Mode Indication	No	No	No
DVR Primary / Secondary Voting	No	Yes	Yes
DVR Tones – MSU Speaker	No	Yes	Yes
PSU Radio Check / Inhibit	No	No	No
PSU LOCATION	No	No	No
PSU P25 Trunking OTAR	NA	NA	NA
PSU Patch	No	No	No
PSU Dynamic Regrouping	No	No	No
PSU Selector Lock /Unlock	No	No	No
PSU Phone Interconnect	No	No	No
PSU Adaptive Power Control	No	No	No
Audio Buffering	No	Yes	Yes
PSU Scan	No	No	No
PSU Announcement Group	No	No	No
P25 Encryption	No	No	Programmable
PSU Status / Message	No	Status only	Status only
PSU PTT ID	No	Yes (MDC1200)	Yes (MDC1200)

## Mixed DVRS Mode

Mixed DVR mode allows analog DVR operation by switching between digital and analog modes as described below. The use of mixed mode for analog DVRS communications is not recommended since it requires special user training to be able to handle the DVR switching between default digital and temporary analog mode as described below.

Mixed DVR mode should only be used when both analog and digital PSUs are required to operate on the same DVR channel. Mixed DVRS mode requires the MSU to be switched to a P25 Digital channel. When a DVR channel is programmed to operate in mixed mode, the DVRS can handle calls from both P25 and analog local PSUs while the same DVR channel is selected on the MSU.

When mixed mode is selected, the DVR can be toggled between digital and analog mode as follows:

- The default DVRS mode is digital i.e. the P25 modem is enabled by default.
- If a call from a local PSU is detected and the DVR does not decode a P25 frame sync within the preprogrammed '**P25 Frame Sync Detection Timer**', the DVR switches to analog mode and starts decoding analog mode signaling (such as DTMF, MDC1200). The DVR repeats analog signals to the local analog PSUs and system MSUs / PSUs on the selected system channel / TG.
- After the local PSU keys off, the DVR stays in the analog mode for the duration of the preprogrammed '**VR Ch Mixed Mode Hold Timer**'. Any outbound calls which are received by the MSU prior to the above timer's expiration will be repeated by the DVR as analog conventional.
- Once the '**VR Ch Mixed Mode Hold Timer**' expires, the DVR returns back to digital mode and any outbound calls are repeated as digital. Inbound analog calls received by the DVR in mixed mode are repeated to the system by the MSU on the selected TG / Channel.
- If TG Proxing is enabled, digital inbound calls received by the DVR are transmitted by the MSU on the TG selected on the local PSU (not on the TG selected on the MSU).

## Special Features Support

### TPS Signaling

Tactical Public Safety (TPS) signaling support can be enabled on a DVR channel, operating in conjunction with a conventional P25, trunking P25 or conventional analog mobile radio channel. This option enables specially programmed local PSUs to transmit TPS Leading and / or Trailing IDs. TPS Emergency can also be received and processed by the DVRS when on the corresponding TPS enabled analog channel.

## Troubleshooting

The following error messages may be displayed on the MSU control head:

CH Display	Description / Action
<b>INCOMP MSU HW</b>	Indicates incompatible MSU hardware (XTL MSU connected to an APX compatible DVR). Ensure to connect a compatible APX MSU or change the DVR to an XTL compatible model.
<b>Alternating VR ERROR and RC ERROR XXXX</b>	Turn the DVRS off and then back on. If it does not correct the condition, note the exact error code and contact Futurecom to obtain an RMA and shipping instructions.
<b>INCOMP MSU SW</b>	Please contact Motorola and Futurecom to obtain compatible firmware upgrades for the radios.
<b>Warning RC0400</b>	Displayed upon power up only indicates that the Primary EEPROM map of the DVR contains corrupted data. The DVR will still operate properly from the backup EEPROM map. To fix the primary map, please use the latest Tweaker to read the DVR. This will restore the Primary EEPROM Map.
<b>VR Error RC1000</b>	Displayed permanently indicates that both the Primary and Backup EEPROM maps are corrupted and the unit is not operation. Please contact Futurecom for further instructions on how to troubleshoot the problem.
<b>RC ERROR 4000</b>	Indicates that the DVR firmware has been updated but its programmed personality has not. The DVR personality needs to be updated by reading the unit with the Tweaker programming software in order to upgrade the EEPROM map as described in the Firmware upgrade instructions provided by Futurecom.
<b>LOW BATTERY</b>	Indicates Low Battery Warning or Alarm.
<b>VR PROGRAMMING</b>	Indicates the VR is being programmed and the MSU is on standby.
<b>ID MISCONFIG</b>	Indicates a PSU ID misconfiguration has been detected. Requires PSU ID change.
<b>SYNC ERROR</b>	Indicates the MSU programming has been changed but the DVR template has not been updated. Requires export and import of the new MSU .XML file in the DVR.
<b>SCN LIST ERR</b>	Displayed temporarily when Scan and DVR are turned ON while band lock is enabled in the DVR and the MSU scan list contains members using the same frequency band as the DVR.

## Appendix 1 – DVR Specifications

General Specifications					
Dimensions: Height / Width / Depth	185mm (7.28") / 186mm (7.32") / 315mm (12.41")				
Weight	10.3kg (22.7lb)				
Channel Spacing	12.5 or 25 kHz programmable				
Number of Channels	192				
CTCSS/DCS	Programmable per Channel				
Power Supply	13.8V DC +/- 20%				
DC Current Drain					
RPTR Off	0.01 A Max				
Standby/Receive	0.8 A Max				
Transmit	4.5 A Max				
Operating Temperature	-30°C to +60°C				
Protection Against Liquids	IP6 (water jet proof)				
Antenna Impedance	50 Ohms				
External Connectors					
Antenna	Mini UHF				
Computer Interface	USB				
Equipment Type Acceptance		VHF	UHF	700	800
FCC	LO6-DVRSVHF	LO6-DVRSUHF	LO6-DVRS700	LO6-DVRS800	
Industry Canada	2098B-DVRSVHF	2098B-DVRSUHF	2098B-DVRS700	2098B-DVRS800	
Transmitter Specification		VHF	UHF	700	800
Frequency Band [MHz]	136-174	380-430 450-470 470-512	764-776	851-870	
Power Output @ Antenna Port	10W (programmable per channel from 1W to 10W)				
TCT Option	15 sec to 15 min or Disabled				
Max Spurious Output	-60dBc				
Frequency Stability	+/- 1.5ppm				
FM Hum and Noise 12.5 / 25 kHz	37 dB / 43 dB				
Audio Response	+1, -3 dB of 6 dB / octave pre-emphasis characteristic over 300 Hz – 3 kHz				
Audio Distortion	<2%				
Receiver Specification		VHF	UHF	700	800
Frequency Band [MHz]	136-174	380-430 450-470 470-512	794-806	806-825	
Receiver Sensitivity	-115 dBm				
Frequency Stability	+/- 1.5ppm				
Selectivity 12.5 / 25 kHz	60 dB / 75 dB				
Intermodulation	70 dB				
Deviation 12.5 / 25 kHz	+/-2.5 kHz / +/-5 kHz				
FM Hum and Noise 12.5 / 25 kHz	37 dB / 43 dB				
Audio Output (Repeater Detect Audio)	600 mV RMS nominal, flat response				
Audio Response	+1, -3 dB of 6 dB / octave pre-emphasis characteristic over 300 Hz – 3 kHz				
Audio Distortion	<2%				

## Contact Information

### **Technical Support**

905-532-1158  
support@futurecom.com

### **Orders**

Please contact Motorola / Drop Ship

### **Return Authorizations**

1-800-701-9180

### **Head Office and Manufacturing**

3277 Langstaff Rd  
Concord, Ontario L4K 5P8  
Canada  
905-660-5548

[www.futurecom.com](http://www.futurecom.com)

## Glossary

Keyword	Description
<b>ACK</b>	Acknowledgement of communications.
<b>AVRA</b>	Automated VR / DVR Activation. DVR Option which permits automated activation of the DVR by either using a VIP input on the MSU CH / DEK or a pin on the DVR Auxiliary cable. Requires external logic / switch, not supplied with the DVRS Hardware.
<b>Band Lock</b>	When enabled, causes the MSU to block usage of the same frequency band as the DVR while the DVR is active. Enabled by default when no in-band filter is present.
<b>BL</b>	Busy Lockout – dynamic voting phase (follows the static Primary / Secondary phase) of the DVR simulcast prevention algorithm.
<b>Channel</b>	A group of characteristics, such as transmit / receive frequency pairs, radio parameters, encryption encoding etc.
<b>Coded Squelch</b>	Tone Private-Line (PL) or Digital Private-Line (DPL). Used on conventional channels for signal validation.
<b>Conventional</b>	Refers to radio-to-radio communications, sometimes through a base station repeater or vehicular repeater.
<b>Dispatcher</b>	An individual who has radio system management duties.
<b>DPD File</b>	DVR personality file saved as <b>file_name.dpd</b> .
<b>DPL Coded Squelch</b>	A continuous sub-audible data signal transmitted with the carrier. See Coded Squelch.
<b>DVR</b>	Digital Vehicular Repeater.
<b>DVR Mode</b>	Determines the communication exchange capabilities between System Users and Local Portable Users; Can be set to OFF, LOCAL or SYSTEM.
<b>DVRS</b>	Digital Vehicular Repeater interfaced to a Remote Mount APX Mobile radio with or without Control Head or to a remote mount XTL2500 / XTL5000 with O3/O5/M5 Control head. <b>This document only describes the APX interfaced DVR.</b>
<b>'DVRS Enabled' PSU</b>	P25 XTS™1500, XTS™2500, XTS™5000, APX™4000, APX™6000 or APX™7000 Portable Radio with enabled DVRS operation.
<b>EPR File</b>	File containing DVR personality (dpd) and calibration data of the specific DVR unit. Typically saved in the following format xxxxxxxx.epr where xxxxxxxx is the SN of the specific DVR.

Keyword	Description
<b>FCC</b>	Federal Communications Commission.
<b>FNE</b>	Fixed Network Equipment – Trunking or Conventional System Infrastructure
<b>Forced Analog Mode</b>	Hybrid DVR Mode of operation where communications between the DVR and the P25 'DVRS enabled' PSUs are digital while the voice communications are forced to be analog when the MSU is operating on a non-P25 channel / TG. When the MSU is operating on a P25 channel / TG, the DVR is operating in Digital mode (digital voice and signaling).
<b>Heart Beat</b>	P25 Message periodically sent by a Primary DVR to other DVRs during Primary/Secondary processing.
<b>HUB</b>	Hang Up Box – refers to the MSU Microphone being on hook or off hook.
<b>ICM</b>	In Car Monitor – when enabled in the MSU, allows the MSU user to monitor voice traffic to and from the local PSU
<b>Inbound Call</b>	A Call transmitted by Local PSU and received by the DVR.
<b>Local Mode</b>	DVR 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 DVR.
<b>Local PSU</b>	PSU switched to the DVR channel and used for communication with the DVR
<b>Local Tx Fallback</b>	When enabled, the MSU reverts to local call if the MSU fails to access the system.
<b>Mode</b>	<b>MSU / PSU</b> - A programmed combination of operating parameters. <b>DVR</b> – OFF, SYSTEM or LOCAL (see <b>DVR Mode</b> )
<b>MPE</b>	Maximum Permissible Exposure.
<b>MSU</b>	Mobile Subscriber Unit
<b>NAC</b>	Network Access Code – used in P25 mode for validation of P25 radio communications, similar to the use of PL/DPL in analog mode. Also used for DVRS Steering.



<b>Keyword</b>	<b>Description</b>
<b>NID</b>	Network ID - see Network Access Code (NAC)
<b>Outbound Call</b>	System Call received by the MSU.
<b>PSU</b>	Portable Subscriber Unit.
<b>PTT</b>	Push to talk. The PTT engages the transmitter (of the Portable or Mobile radio and / or DVR) when pressed.
<b>RF</b>	Radio Frequency. Part of the general frequency spectrum 10kHz - 10,000,000 MHz.
<b>RSSI</b>	Received Signal Strength Indicator.
<b>System Mode</b>	DVR mode which provides extended voice and signaling communications between System Users and Local Portable Users over the selected DVR channel / Mobile Radio Mode.
<b>Talk Group</b>	A group of radio users who communicate with each other by using the same communication path.
<b>Talk Group Translation</b>	Feature where the PSU talkgroup is translated by the DVR to match the currently selected MSU talkgroup.
<b>Trunking</b>	The automatic sharing of radio frequencies by large number of users based on communication path sharing for the length of a conversation.
<b>Tweaker</b>	DVRS Programming Software Application

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