MOBEXCOM P25

DIGITAL VEHICULAR REPEATER

APX Series Mobile Radios P25 Interface

FUTURECOM

Installation & Programming Guide

8M083X25 R6 October 2015

NOTES

Related Publications

Publication Number	Description
8A083X30	**DVRS User's Manual, APX Series Interface**
8A083X20	**DVRS User's Manual, XTL2500 / XTL5000 Interface**
8A083X21	**Tactical DVR User's Manual**
8M083X02	**Tactical DVR Installation and Programming Guide**
8F083X03	**DVRS - Product & RF Safety Booklet**
8F083X14	**Indoor Fixed Mount DVRS – Installation Guide, APX Interface**
8F083X15	**Outdoor Fixed Mount DVRS – Installation Guide, APX Interface**
8F083X16	**Transportable DVRS – Installation Guide, APX Interface**

Manual Revisions

Rev #	Date	ECN	Notes & References
0	July 5 2013	na	Original Release
1	August 7, 2013	13031	Encryption restrictions update
2	November 22, 2013	13041	Firmware R1.01 / Tweaker 1.02 update
3	December 8, 2014	14062	Firmware R1.10 Update
4	July 22, 2015	15026	Firmware R1.20 / SR7.15.5 Update
5	September 3, 2015	15042	Removed APX2500/APX4500
6	October 15, 2015	15053	Firmware R1.21 / Q4 2015 SER Update

Foreword

The P25 Digital Vehicular Repeater (**DVR**) is designed to be seamlessly interfaced to:

- Remote Mount XTL2500 or XTL5000 Digital Mobile Subscriber Unit (**MSU**) with **M5**, **O3 or O5** Control Head
- Remote Mount APX Series **MSU** with or without control head

This manual provides Installation and Programming guidelines for the Futurecom Mobexcom P25 DVR that is interfaced to the following remote mount APX Series Mobile radios:

Mobile Radio Model	Firmware Requirements	Notes
APX5500	R14.04.00 or later	Requires option **GA00631**
APX6500	R14.04.00 or later	Requires option **GA00631**
APX7500	R14.04.00 or later	Requires option **GA00631**
NOTE: Mobile Radio must be configured as Remote Mount in order to be compatible with the DVRS.		

For Installation and Programming guidelines of the XTL interfaced DVRS models, please refer to publication **8M083X01**.

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

The DVR may also be used as a stand alone (Tactical) repeater. The operation of the Tactical DVR is described in publication **8A083X21**. The Installation & Programming Guidelines referring to the Tactical DVR Model are described in document **8M083X02**.

For details on the DVRS Operation, please refer to the DVRS User's Guides **8A083X20** (XTL interface) or **8A083X30** (APX interface).

For details on the APX series Mobile Radios operation, please refer to the applicable Manuals available from Motorola.

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

APX Series Mobile Radios - firmware release: **Host R14.04.00 or later.**
APX Mobile Radio Control Head - firmware release **R20.00.00 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 – firmware release **R09.00.00 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 R01.21 or later.
Tweaker Programming software **6A083X05** – Version **1.06 or later.**

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The Tweaker Programming Software provided by Futurecom Systems Group ULC includes the following Publicly Available Software.

Publicly Available Software List

Name: MFC Grid Control

Version: 2.24

Modified: Yes

Software Site: http://www.codeproject.com/KB/miscctrl/gridctrl.aspx

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Part I – DVRS INSTALLATION

Part I - Installation

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

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

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 Digital Vehicular Repeater (DVR) is designed to be seamlessly interfaced to:

- Remote Mount XTL5000 Digital Mobile Radio with O5 or O3 Control Head
  Or
- Remote Mount XTL2500 Digital Mobile Radio with M5 Control Head
  Or
- Remote Mount APX Series Mobile Radios with or without a control head (O2, O3, O5, O7 or O9):

Mobile Radio Model	Firmware Requirements	Notes
APX5500	R14.04.00 or later	Requires option **GA00631**
APX6500	R14.04.00 or later	Requires option **GA00631**
APX7500	R14.04.00 or later	Requires option **GA00631**
NOTE: Mobile Radio must be configured as Remote Mount in order to be compatible with the DVRS.		

IMPORTANT!
This manual described the DVR models that are interfaced to the APX Series Mobile Radios via P25 Interface. The MSU configured for DVRS operation can support up to two Control Heads.

The P25 DVRS allows Portable Subscriber Units (**PSU**) to be used in areas where only Mobile Subscriber Unit (**MSU**) coverage is available and portable radio coverage is either intermittent or completely absent. Installed in the trunk of a car, fire truck, armored vehicle, ambulance, the P25 DVRS extends radio communications to the PSU users who are outside of the vehicle, inside a nearby building or in any marginal portable radio coverage areas. The DVRS extends voice (analog or digital, clear or encrypted) communications and supports key trunking system features. The DVRS can be configured to provide various advanced options to the users.

Table 1 provides information on the DVRS infrastructure compatibility options.

FIXED NETWORK TYPE / MOBILE RADIO MODE					
Portable Radio Type / Mode	**Conventional Analog incl. Mixed Receive**	**Conventional P25 incl. Mixed Receive**	**3600 Analog / Digital Trunking**	**9600 P25 Trunking FDMA**	**9600 P25 Trunking TDMA**
Conventional Analog	**YES** A	**YES** A/M	**YES** A	**YES** A/M	**YES** A
Generic P25 Conventional	**NO**	**YES** D/M	**NO**	**YES** D/M	**NO**
P25 Conventional 'DVRS Enabled'	**YES** FA	**YES** D/FA/M	**YES** FA	**YES** D/FA/M	**YES** FA

Table 1 DVRS vs Infrastructure Compatibility

DVRS Channel Types:
A = Analog, D = Digital, M = Mixed, FA = Forced Analog (see Part II of this manual)

Identifying Your DVRS Model

Frequency Band of Operation

Depending on the frequency band of operation of the APX 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**.

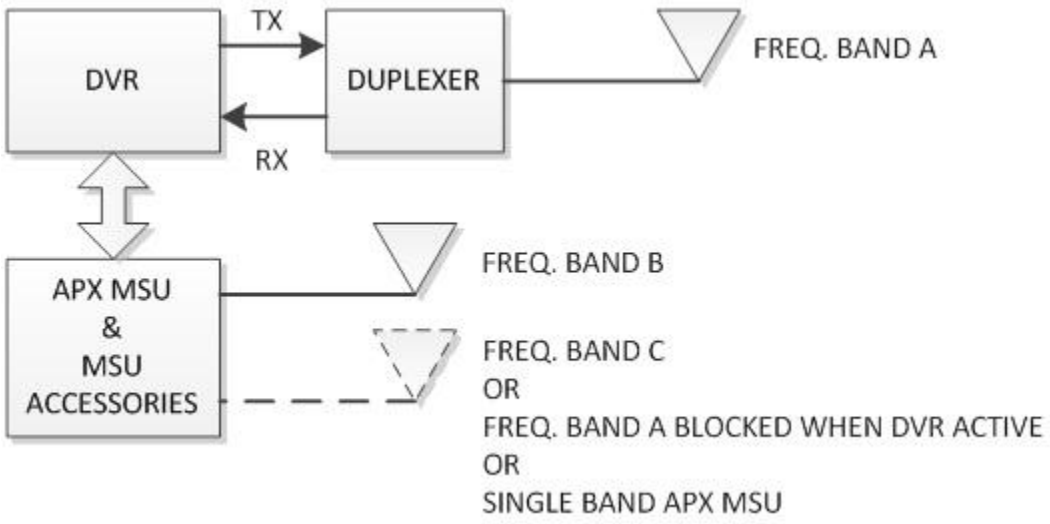


Figure 1 Cross-Band Full Duplex & Simplex Capable DVRS - Conceptual Diagram

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.

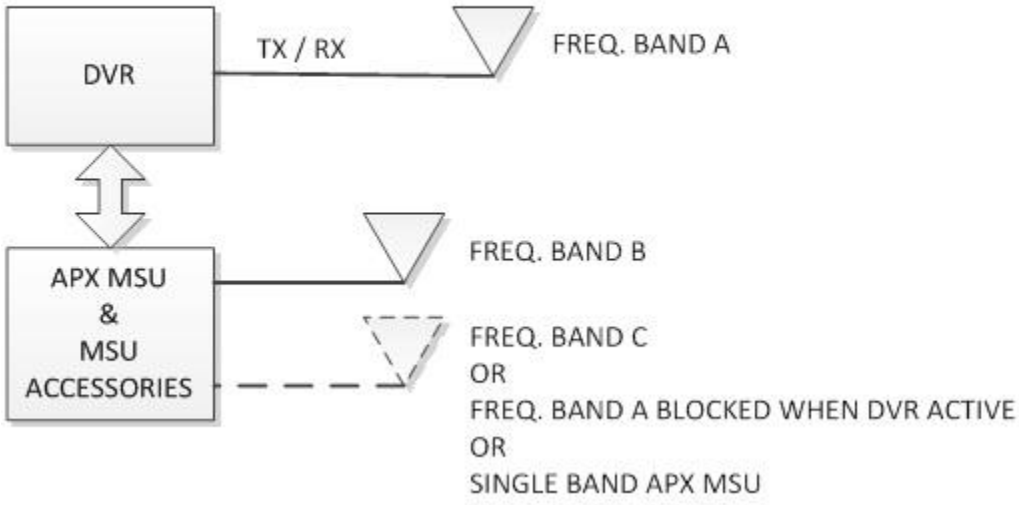


Figure 2 Cross-Band Simplex Only Capable DVRS - Conceptual Diagram

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.

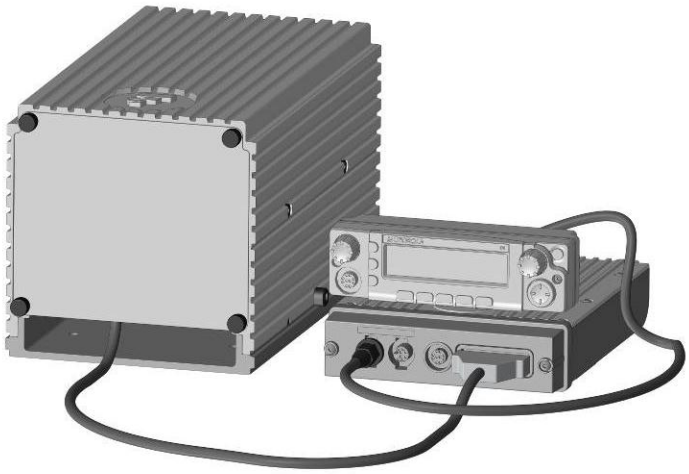


Figure 3 Vehicular Mount Cross Band DVRS Model – Full Duplex & Simplex Capable

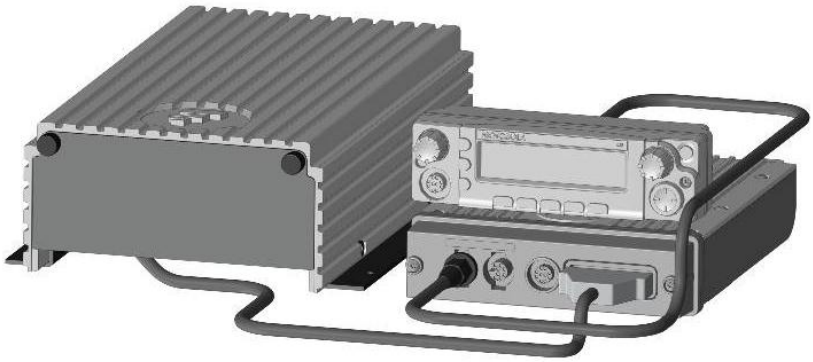


Figure 4 Vehicular Mount Cross Band DVRS Model - Simplex Only Capable

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 filter 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 MSU in-band antenna is mounted on the roof top of the vehicle while the DVR antenna is mounted on the trunk. Each DVRS is shipped equipped with custom filters tuned to the specified frequency bands – note the frequency range specified on the filter labels. Programming the DVR / MSU 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” mode is selected on the MSU CH, the RF Switch 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 require two or three (in the case of dual band MSU) separate antennas.

IMPORTANT!
In all In-Band DVRS configurations, the MSU Transmit power must not exceed 50 Watts on DVRS Enabled MSU Modes due to the in-band filters power rating.
The in-band filters connected to the MSU have typical insertion loss of 1.5dB.

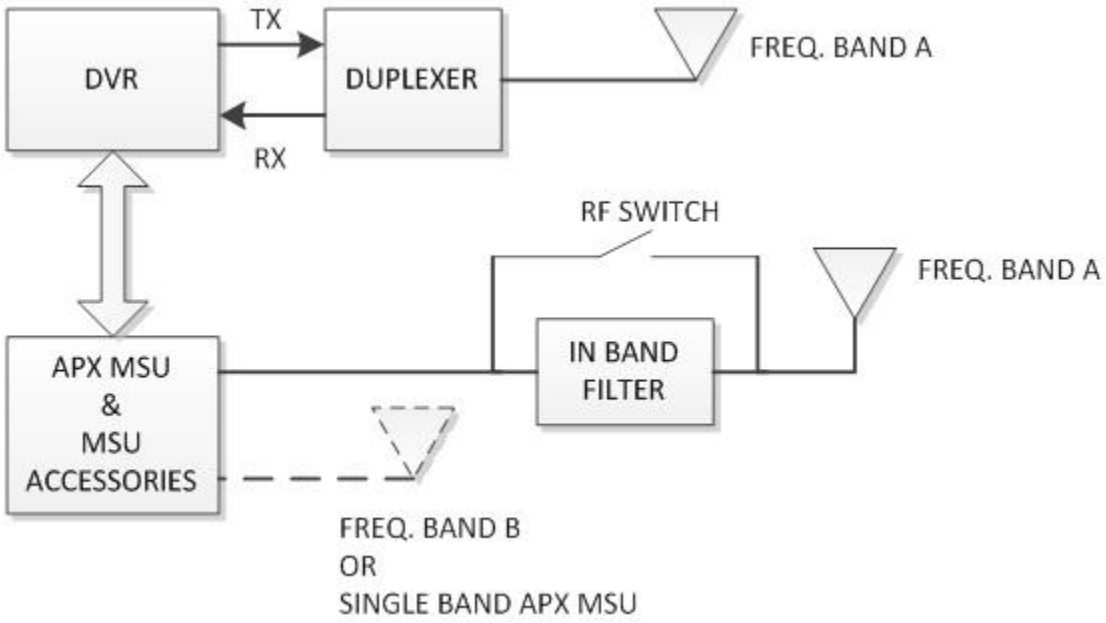


Figure 5 In-Band Full Duplex / Simplex Capable DVRS - Conceptual Diagram

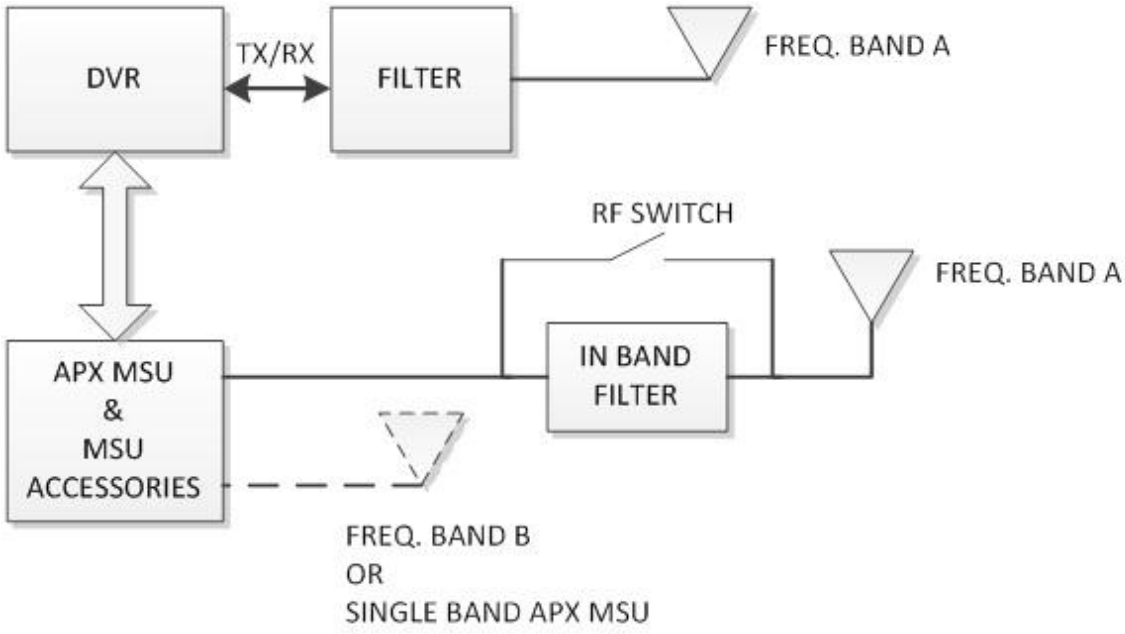


Figure 6 In-Band Simplex Only Capable DVRS - Conceptual Diagram

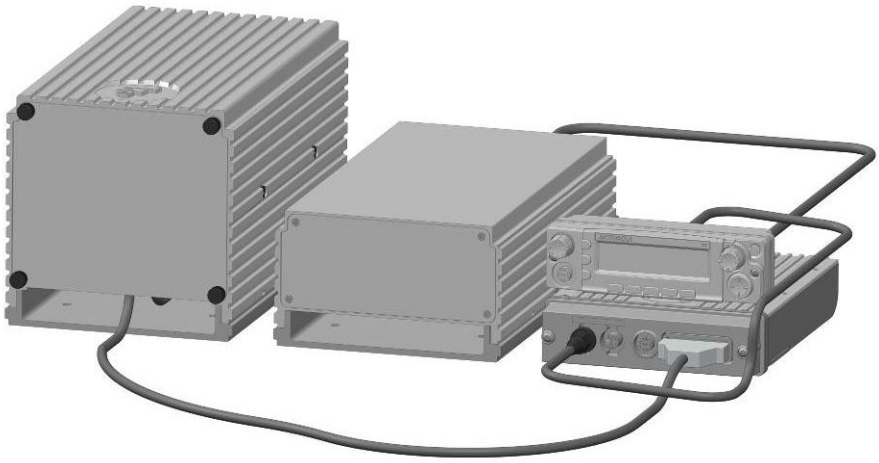


Figure 7 Vehicular Mount In-Band 700 or 800MHz DVRS Model - Full Duplex & Simplex Capable

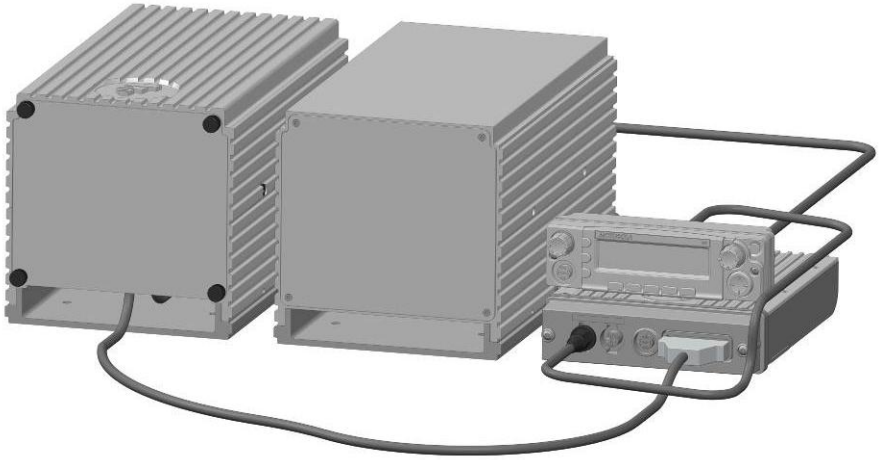


Figure 8 Vehicular Mount In-Band VHF or UHF DVRS Model - Full Duplex & Simplex Capable

APX MSU Model	VHF (136-174MHz) DVRS Models	Reference
Dual Band APX MSU 700/800MHz & VHF	• X-Band with band locked VHF, Full Duplex • X-Band with band locked VHF, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 8
Dual Band APX MSU 700/800MHz & UHF R1	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Dual Band APX MSU 700/800MHz & UHF R2	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Dual Band APX MSU UHF R1 & VHF	• X-Band with band locked VHF, Full Duplex • X-Band with band locked VHF, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 8
Dual Band APX MSU UHF R2 & VHF	• X-Band with band locked VHF, Full Duplex • X-Band with band locked VHF, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 8
Dual Band APX MSU UHF R1 & UHF R2	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU VHF	• In-Band Full Duplex • In-Band Simplex	Fig. 5 & 7 Fig. 6 & 8
Single Band APX MSU UHF R1	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU UHF R2	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU 700 / 800MHz	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4

Table 2 VHF DVRS Configurations

APX MSU Model	UHF (380-430; 450-470; 470-512MHz) DVRS Models	Reference
Dual Band APX MSU 700/800MHz & VHF	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Dual Band APX MSU 700/800MHz & UHF R1	• X-Band with band locked UHF, Full Duplex • X-Band with band locked UHF, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 8
Dual Band APX MSU 700/800MHz & UHF R2	• X-Band with band locked UHF, Full Duplex • X-Band with band locked UHF, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 8
Dual Band APX MSU UHF R1 & VHF	• X-Band with band locked UHF, Full Duplex • X-Band with band locked UHF, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 8
Dual Band APX MSU UHF R2 & VHF	• X-Band with band locked UHF, Full Duplex • X-Band with band locked UHF, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 8
Dual Band APX MSU UHF R1 & UHF R2	• In-Band Full Duplex • In-Band Simplex	Fig. 5 & 7 Fig. 6 & 8
Single Band APX MSU VHF	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU UHF R1	• In-Band Full Duplex • In-Band Simplex	Fig. 5 & 7 Fig. 6 & 8
Single Band APX MSU UHF R2	• In-Band Full Duplex • In-Band Simplex	Fig. 5 & 7 Fig. 6 & 8
Single Band APX MSU 700 / 800MHz	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4

Table 3 UHF DVRS Configurations

APX MSU Model	700MHz DVRS Models	Reference
Dual Band APX MSU 700/800MHz & VHF	• X-Band with band locked 700/800, Full Duplex • X-Band with band locked 700/800, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 7
Dual Band APX MSU 700/800MHz & UHF R1	• X-Band with band locked 700/800, Full Duplex • X-Band with band locked 700/800, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 7
Dual Band APX MSU 700/800MHz & UHF R2	• X-Band with band locked 700/800, Full Duplex • X-Band with band locked 700/800, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 7
Dual Band APX MSU UHF R1 & VHF	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Dual Band APX MSU UHF R2 & VHF	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Dual Band APX MSU UHF R1 & UHF R2	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU VHF	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU UHF R1	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU UHF R2	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU 700 / 800MHz	• In-Band Full Duplex • In-Band Simplex	Fig. 5 & 7 Fig. 6 & 7

Table 4 700MHz DVRS Configurations

APX MSU Model	800MHz DVRS Models	Reference
Dual Band APX MSU 700/800MHz & VHF	• X-Band with band locked 700/800, Full Duplex • X-Band with band locked 700/800, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 7
Dual Band APX MSU 700/800MHz & UHF R1	• X-Band with band locked 700/800, Full Duplex • X-Band with band locked 700/800, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 7
Dual Band APX MSU 700/800MHz & UHF R2	• X-Band with band locked 700/800, Full Duplex • X-Band with band locked 700/800, Simplex • In-Band & X-Band Capable, Full Duplex • In-Band & X-Band Capable, Simplex	Fig. 1 & 3 Fig. 2 & 4 Fig. 5 & 7 Fig. 6 & 7
Dual Band APX MSU UHF R1 & VHF	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Dual Band APX MSU UHF R2 & VHF	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Dual Band APX MSU UHF R1 & UHF R2	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU VHF	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU UHF R1	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU UHF R2	• X-Band Full Duplex • X-Band Simplex	Fig. 1 & 3 Fig. 2 & 4
Single Band APX MSU 700 / 800MHz	• In-Band Full Duplex • In-Band Simplex	Fig. 5 & 7 Fig. 6 & 7

Table 5 800MHz DVRS Configurations

DVR Dimensions

Cross-Band DVR Dimensions

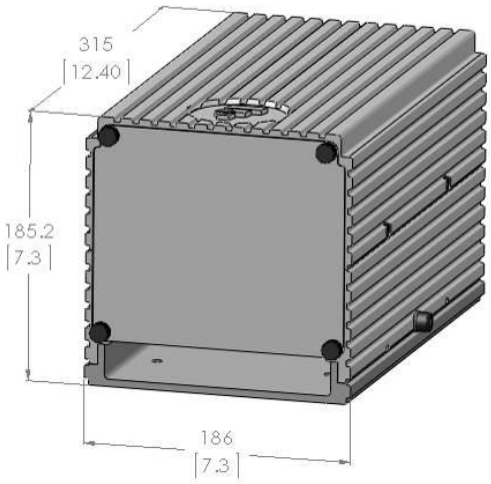


Figure 9 Cross-Band DVR (Full Duplex and Simplex Capable) - Dimensions mm / [in]

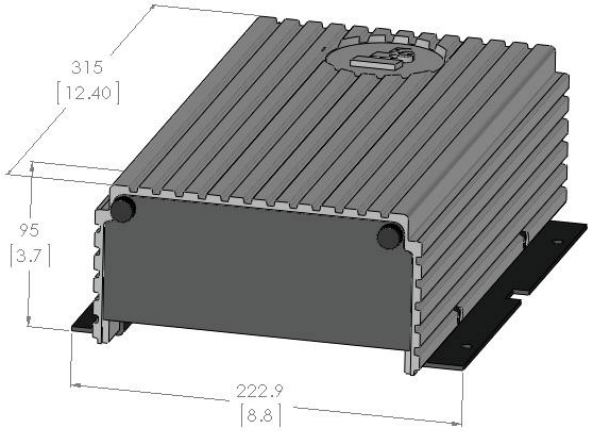


Figure 10 Cross-Band Simplex Only Capable - Dimensions mm / [in]

In-Band DVR Dimensions

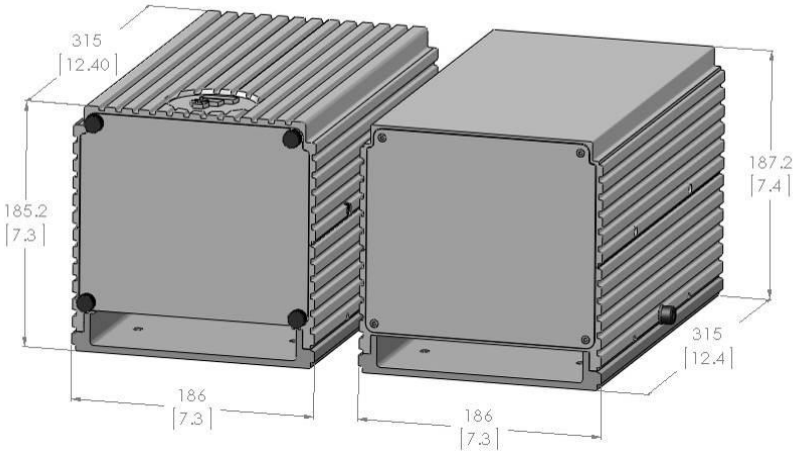


Figure 11 Typical VHF/UHF In-Band DVR (Full Duplex & Simplex) - Dimensions mm / [in]

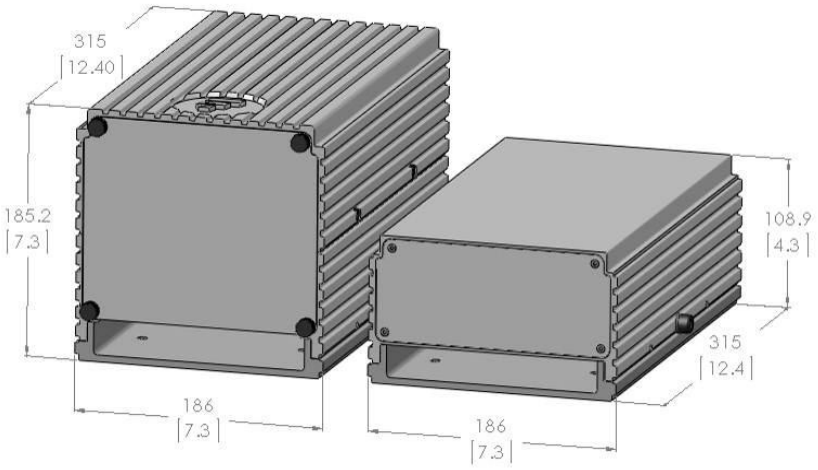


Figure 12 Typical 700 / 800 In-Band DVR (Full Duplex & Simplex) - Dimensions mm / [in]

DVRS Installation Basics

Planning the Installation

Before starting the installation, inspect the vehicle and determine how and where you intend to mount the two DVRS antennas (one or two connected to the Mobile Radio and one to the DVR), the DVR components, MSU, Control Head, MSU accessories. Ensure to provide adequate separation between the Mobile radio antennas and the DVR antenna, especially in in-band configurations.

When planning the DVRS installation, make sure to leave adequate room around all DVRS modules to allow for easy RF and Control cabling connections, to enable programming / re-flashing access to both the DVR and MSU ports and access to the DVR mounting screws.

Ensure all DVRS components are mounted within the interconnecting cables range.

The DVRS operates only in negative ground, +12VDC electrical systems. Before starting the installation, make sure that the ground polarity of the vehicle is correct. Accidentally reversing the polarity will not damage the radio, but will cause the cable fuses to blow.

CAUTION!
Before installing any electrical equipment, check the vehicle manufacturer's User Manual.

Installation Tools Required

Description	Needed for:
Drill	Mounting base installation screws.
Center Punch	Mounting base installation screws.
6mm Allen Key	Tightening the 8mm machine screws for securing DVR/Filters to their mounting bases.
Wire Cutters and Crimping Tool	DC power cable installation.
#1 Philips Screwdriver	Tightening of cover screws.
3/16" Flat Screwdriver	Tightening of connector screws.

Mounting the DVR

Cross-Band DVRS Mounting

1. Select the locations of the DVR and MSU such that the interconnecting cable can reach and there is enough space for securing the side thumbscrews of the DVR.
2. Using the mounting base as a template, mark the positions of the 6 holes on the mounting surface.
3. Center-punch the spots you have marked and realign the mounting base in position.
4. Secure the mounting base with six self-drilling screws. 6mm or ¼" screws are recommended.
5. Leave enough room for adequate access to the DVR connectors and screws.
6. Route the cables through the mounting base as required.
7. Drop the DVR Assembly into the mounting base and slide it back.
8. Secure the DVR assembly with the two 8mm machine screws and split spring lock washers provided.
9. Tighten the 8mm machine screws with the 6mm Allen Key. The required tightening torque is 21.7 Nm (16 lb in).
10. Connect all cables and then secure the front and rear DVR covers by tightening the 4 thumbscrews provided.

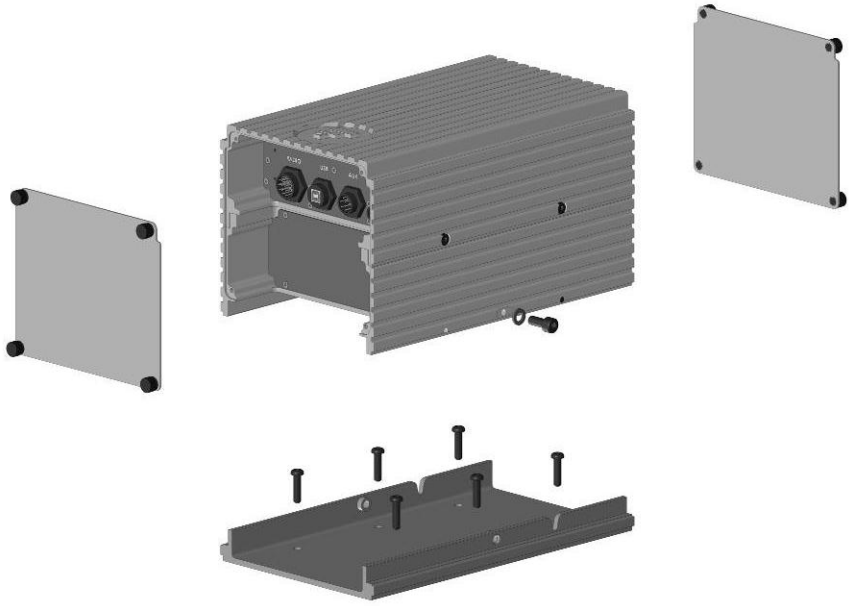


Figure 13 DVR Mounting Details – Full Duplex (With Duplexer)

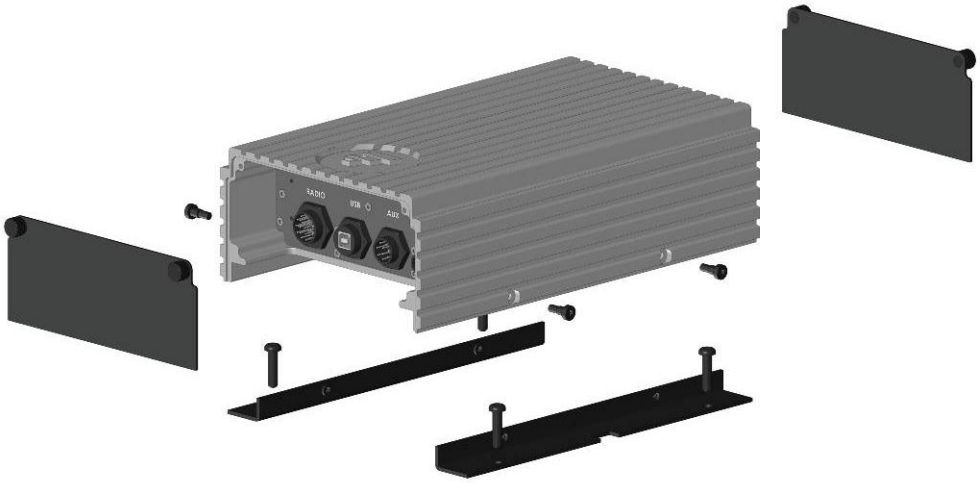


Figure 14 DVR Mounting Details – Simplex Only Capable (No Duplexer)

In-Band DVRS Mounting

1. Select the locations of the DVR, in-band filters and MSU such that the interconnecting cables can reach and there is enough space for securing the side thumbscrews.
2. Using the mounting base as a template, mark the positions of the 12 holes on the mounting surface.
3. Center-punch the spots you have marked and realign the mounting base in position.
4. Secure the mounting bases with six self-drilling screws. 6mm or ¼" screws are recommended.
5. Leave enough room for adequate access to the DVRS connectors and screws.
6. Route the cables through the mounting bases as required.
7. Drop the DVR and the Notch Filter Assemblies into the mounting bases and slide each back.
8. Secure the DVR assembly with the two 8mm machine screws and split spring lock washers provided.
9. Tighten the two 8mm machine screws with the 6mm Allen Key. The required tightening torque is 21.7 Nm (16 lb in).
10. Repeat step 9 to install the Notch filter assembly.
11. Connect all cables and then secure the front and rear DVR covers by tightening the 4 thumbscrews provided.
12. Secure the rear Notch Filter cover by tightening the 4 thumbscrews provided.

Mounting the Mobile Radio

For detailed Mobile Radio and accessories Installation Instructions, please refer to the Installation Manuals available from Motorola. Ensure the Remote Mount MSU is mounted beside the DVR within the range of the DVRS cabling.

NOTE:
Unless special cabling length is specified upon placing an order, the DVR is shipped with a standard 3ft-long interconnect cable between the MSU and DVR.

Connecting the DVRS Cables

NOTE:
The DVRS antenna ports (both DVR and APX sides) are mini UHF female and require antennas with matching mini UHF male terminations. Simplex Cross-Band Models (without any filters) require an antenna with TNC male connector.

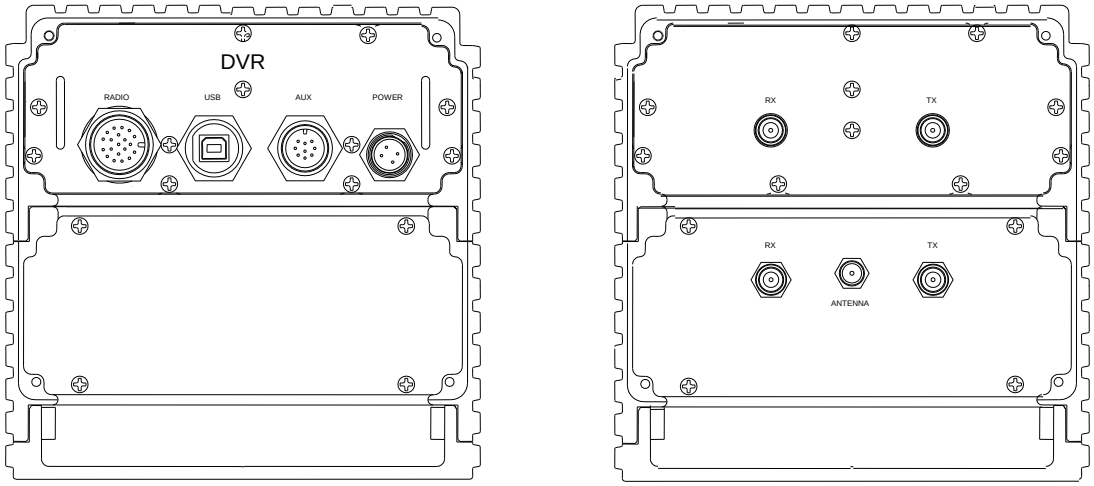


Figure 15 DVR Connectors - Front and Back View (With Duplexer)

Power Cable

IMPORTANT!
The DVRS operates only in negative ground, +12VDC electrical systems. Before starting the installation, make sure that the ground polarity of the vehicle is correct.

1. Determine power cable routing between the VRS mounting location and the vehicle battery.
2. Locate an existing hole with a grommet in the vehicle firewall. If a firewall hole does not exist, drill an access hole in the firewall for cable passage. Install a grommet in the hole to avoid damage to the power cable.
3. From the inside of the vehicle, feed the red lead (without lug attached) through the access hole into the engine compartment.
4. Find a grounding point close to the VRS location. Shorten the black lead.

5. Strip the end of the black lead as required. Crimp the large lug on the black lead and connect it to the vehicle chassis ground.
6. Trim the red lead to the proper length. Strip the end of the red lead as required. Crimp the large lug on the red lead.
7. Locate the fuse holder as close to the battery as possible and away from hot engine parts. Cut the red lead at this location and pull both cut ends through the fuse holder holes. Strip both ends and crimp the metal fuse holder ends on both ends. Install the fuse and close the fuse holder.
8. Connect the red lead lug to the battery positive (+) terminal.

RF Cables

The following RF cables are provided with the respective In-Band DVR Models:

PN	Order Code	Description	Length	Connectors	DVR Models
7W083X17-01	DDN9034	MSU to in-band filtering	3 feet	Mini UHF male	All In-Band Models.
7W083X16-01	DDN9033	DVR Ant to In-Band Filtering	3 feet	Mini UHF male	VHF & UHF In-Band Models.

Table 6 DVRS RF Cables

Control Cables

The following Control Cable types are available:

Part Number:	7W083X05-01	1W083B09-01
Order Code	**DDN9028**	**DDN9029**
Description	Standard MSU – DVR Control Cable	Optional MSU – DVR Control Cable. Used when the MSU is interfaced to Siren HLN1439C
Connector Type - Mobile Radio End	DB25 Male	DB25 Male → to MSU DB25 Female → to Siren Cable
Connector Type - DVR End	Over-molded 20-PIN Female	Over-molded 20-PIN Female
Length	915mm (36”) (Custom lengths up to 7620mm = 300” are available)	915mm (36”)

Table 7 DVRS Control Cable Types

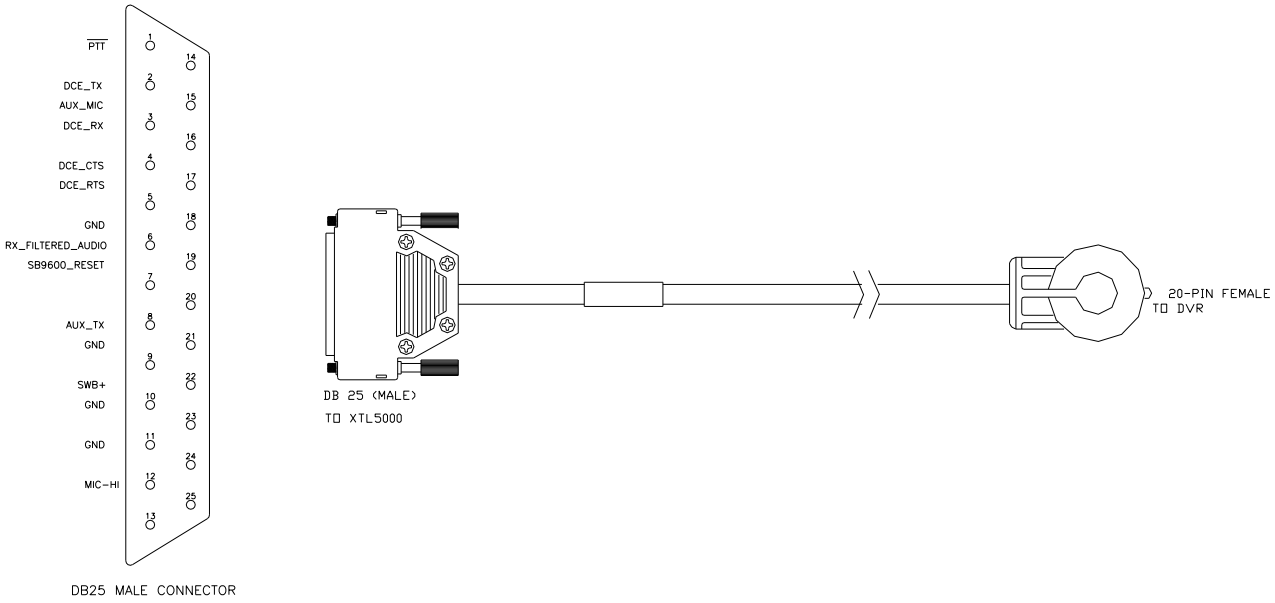


Figure 16 DVR-to- MSU Control Cable 7W083X05-01

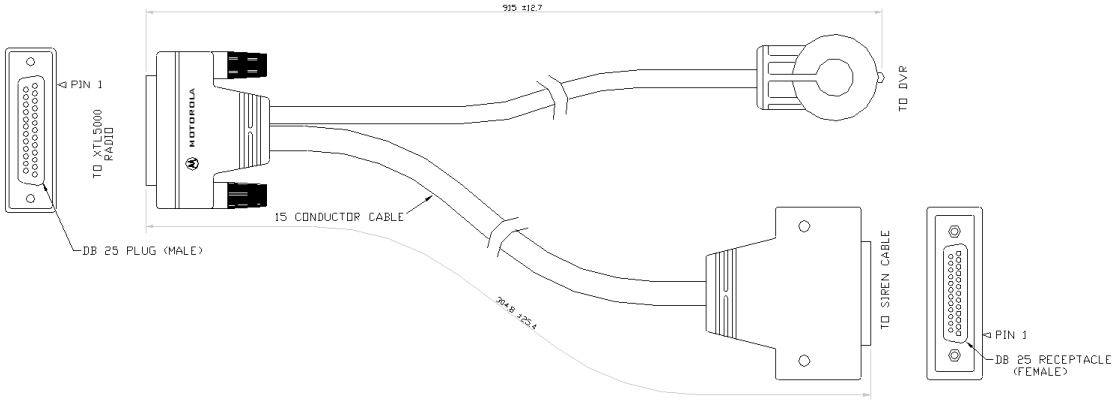


Figure 17 DVR-to- MSU (with Siren) Control Cable 1W083B09-01

NOTE:
Only one of the above Control Cables (shown on **Figure 16** and **Figure 17**) is required per DVRS Installation.

Option Cables

The DVR Auxiliary port provides three Relay Driver Output Ports and two Switch Contact Input Ports, which can be interfaced to external logic. The DVR Auxiliary port is extended by the DVR Auxiliary jumper cable **PN 7W083X06**.

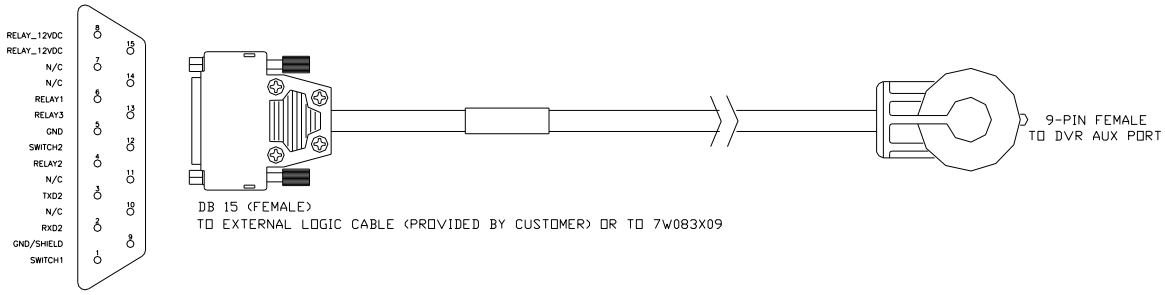


Figure 18 DVR Auxiliary Cable - 7W083X06-01

In-Band DVRS Option Cables

RF Switch Cable

Connect the DB9 Female connector of the **7W083X09** cable to the DB9 male port labeled '**TO AUX'** which is located on the DVRS In-Band filtering shelf.
Connect the other end of the **7W083X09** cable to the matching DB15 connector of the **7W083X06** cable.
Connect the over-molded 9-pin connector of **7W083X06** to the matching DVR connector labeled '**AUX'**.
To enable the RF Switch operation, the '***MSU RF Bypass Switch***' box in the DVRS Hardware Setup menu must be checked.

Other Option Cables

To connect other external logic to the DVR, the DB15 connector of the RF Switch cable **7W083X09** can be opened and extra wires added to the corresponding pins as described in the **DVR Options** section of this document.

Cross-Band DVRS Option Cables

Connect the over-molded 9-pin connector of cable PN **7W083X06** to the matching DVR connector labeled '**AUX**'.
Terminate the required external logic option cable (provided by others) with a DB15 male connector with the required pin out and connect it to the DB15 female connector of the **7W083X06** cable.
The external logic options must be enabled in the DVR personality as described in the **DVR Options** section of this document.

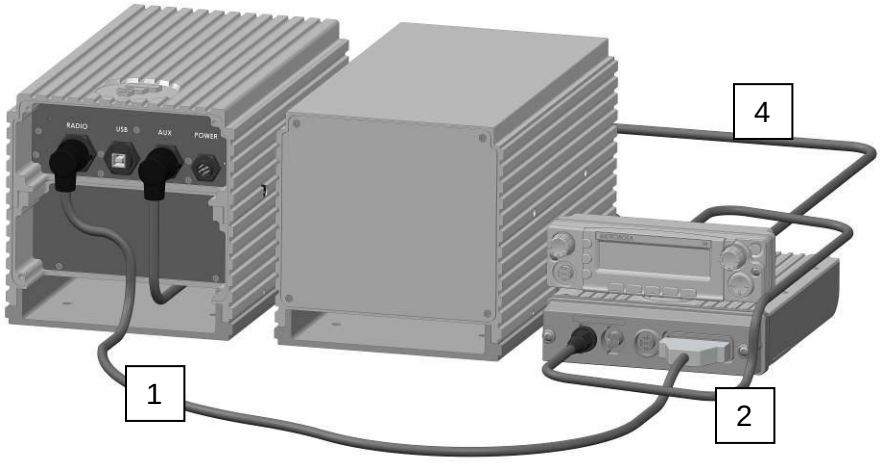


Figure 19 In-Band VHF or UHF DVRS Interconnect Cabling - Front

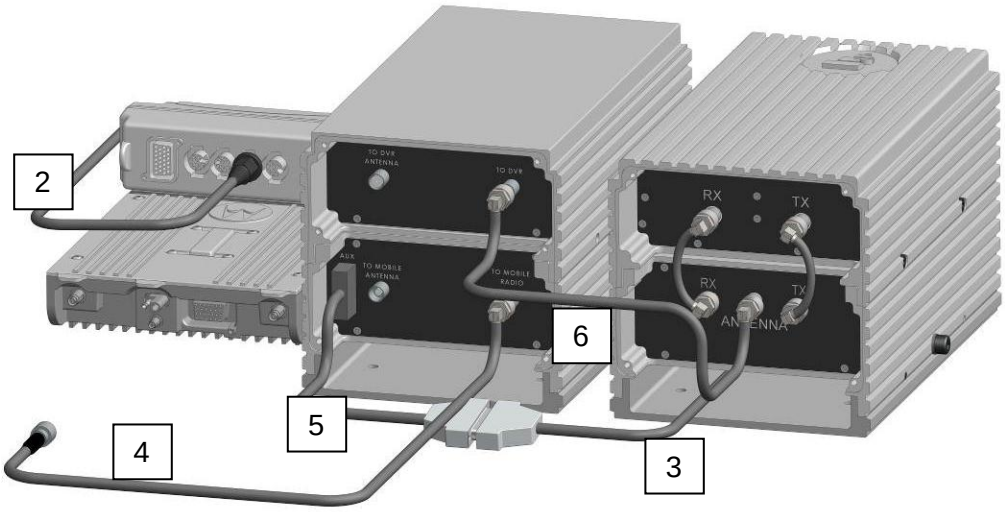


Figure 20 In-Band VHF or UHF DVRS Interconnect Cabling - Back

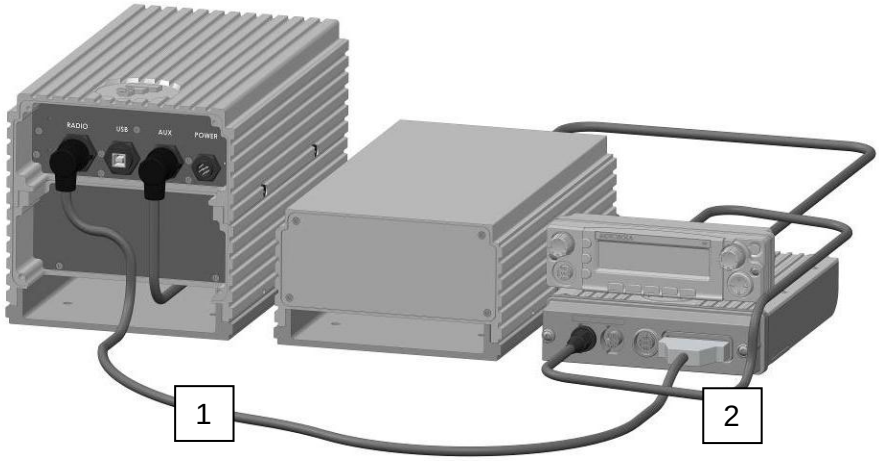


Figure 21 In-Band DVRS (700 or 800MHz) Interconnect Cabling - Front

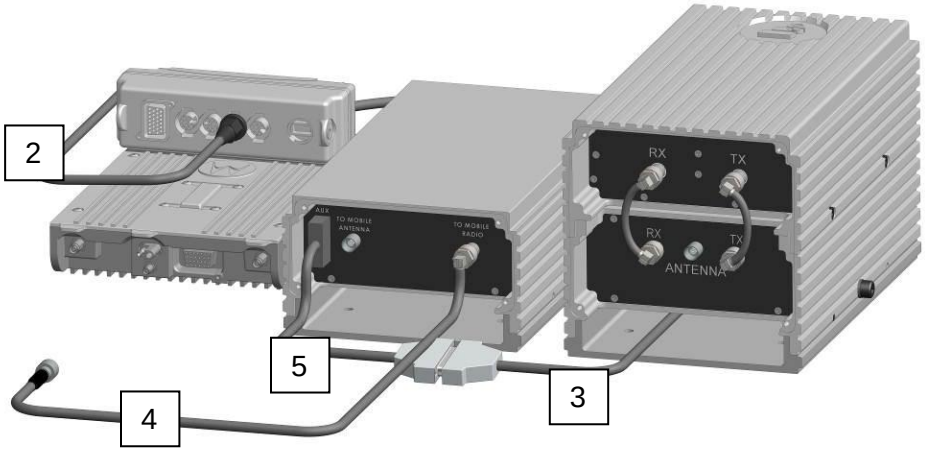


Figure 22 In-Band DVRS (700 or 800MHz) Interconnect Cabling - Back

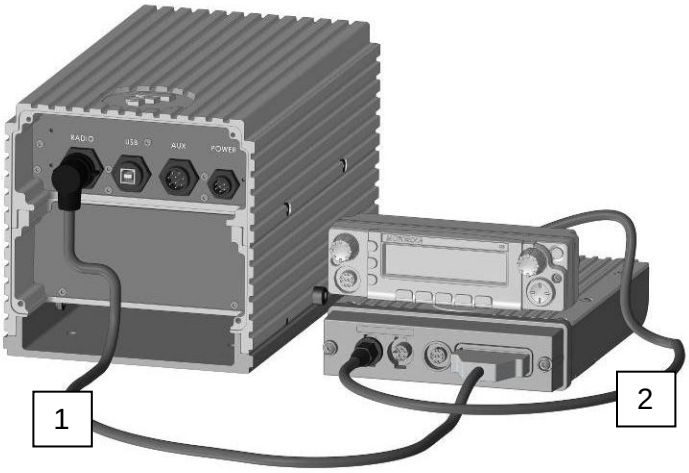


Figure 23 Cross-Band Full Duplex & Simplex Capable DVRS Interconnect Cabling - Front

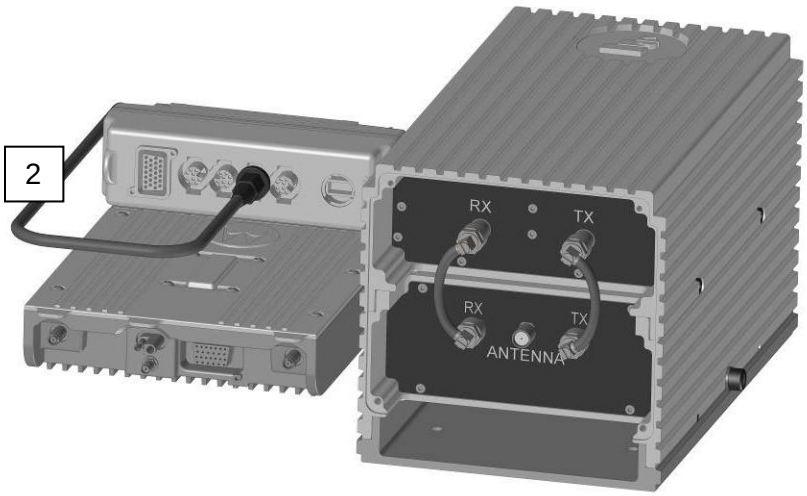


Figure 24 Cross-Band Full Duplex & Simplex Capable DVRS Interconnect Cabling – Back

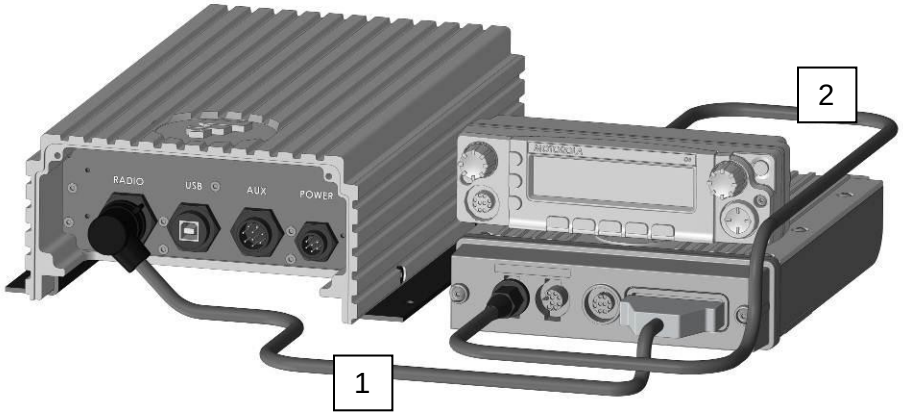


Figure 25 Cross-Band Simplex Only Capable DVRS Interconnect Cabling – Front

Figure 26 Cross-Band Simplex Only Capable DVRS Interconnect Cabling – Back

Ref #	PN	Length	Order Code	Notes
1a	7W083X05-01	3ft	DDN9028	DVR to MSU Control Cable Custom lengths available – up to 25ft.
1b	1W083B09-01	3ft	DDN9029	Replaces 1a if a Motorola Siren is to be interfaced to the MSU.
2	Control Head cable provided by Motorola			
3	7W083X06-01	2.5ft	DDN9031	Auxiliary Cable.
4	7W083X17-01	3ft	DDN9034	MSU to In-Band Filtering RF Cable
5	7W083X09-01	1ft	DDN9032	RF switch option cable
6	7W083X16-01	3ft	DDN9033	DVR to In-Band Filtering RF Cable
-	1W083A01-01	18ft	DDN9030	DVR Power cable

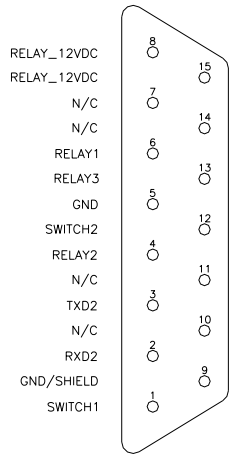
Table 8 Summary of DVRS Control and RF Cables

DVR Options

The DVR Auxiliary port provides three relay driver output ports and two switch contact input ports, which can be interfaced to external logic. The DVR Auxiliary port is extended by the DVR jumper cable PN **7W083X06**. The external logic can be easily interfaced by connecting to the correct pins on the DB15 connector as described in the next paragraph.

DVR Auxiliary Cable

The DVR Auxiliary Cable (PN **7W083X06**) extends the DVR AUX port pins to a DB15 connector for easy connection to the required external logic. The DB15 pinout is shown below.



Pin #	Designation	*Note*
1	SWITCH 1	*Alternative AVRA Input, operating as programmed in the Tweaker Hardware Setup Scree.n*
2	RXD2	*RS232 Input*
3	TXD2	*RS232 Output*
4	RELAY 2	*Primary Light Output / as programmed*
5	GND	*Ground*
6	RELAY 1	*RF Switch Output / as programmed*
7	NOT USED	-
8	RELAY_12VDC	*12VDC for powering up relay coil. Max current draw is 750mA TOTAL from both pins 8 & 15.*
9	GND/SHIELD	*Ground / Shield*
10	NOT USED	-
11	NOT USED	-
12	SWITCH 2	*For future use*
13	RELAY 3	*As programmed*
14	NOT USED	-
15	*RELAY_12VDC*	*12VDC for powering up relay coil. Max current draw is 750mA TOTAL from both pins 8 & 15.*

Figure 27 Auxiliary Cable (7W083X06-01) DB15 Pinout

AVRA

The Automated VR Activation (AVRA) option enables automated DVR ON/OFF control triggered by an external switch – portable charger, door switch etc.

If this option is desired, the external switch (provided by others) needs to be wired to one of the following:

A dedicated VIP Input on the MSU Control Head or DEK.

- The 'Automatic VR Activation' and 'AVRA Uses VIP on CH' selection boxes in the DVRS Hardware Setup menu must be checked.
- The corresponding VIP I/P must be enabled in the MSU – refer to the programming guide provided by Motorola for detailed instructions.

For detailed instructions on VIP wiring, please refer to the MSU installation manuals available from Motorola.

'Switch 1 Input' on the DB15 of the DVR Auxiliary Cable (PN **7W083X06**).

- The 'Automatic VR Activation' selection box in the DVRS Hardware Setup Menu must be checked.
- The 'AVRA Uses VIP on CH' selection box in the DVRS Hardware Setup menu must be left blank (unchecked).
- The MSU does not require special programming related to the enabling of this option.

Status Lights

The Status Lights option provides status identification capabilities. The relay outputs in the DVRS can be programmed to provide several status indications – 'Master Light', 'LOC Mode Light', 'SYS Mode Light' or 'DVR ON Light'.
The DVR then provides control input to an external switch which in turn toggles an external light.
The external switch and light are not included with the DVR.
The Light Switch Relay Coil "+" must be wired to +12V DC and the "-" to the corresponding Relay Output on the DB15 connector of the DVR Auxiliary cable PN **7W083X06** (500mA Max).

External Alarm

In applications where the DVR is installed in a fixed 19" rack, the external alarms option can be enabled and the corresponding relay output wired up to an external logic system for monitoring and reporting of 'low power' or 'overt temperature' combined alarms.

DVRS Antenna Installation

Any DVRS model requires the use of two or three antennas – one or two connected to the MSU and one connected to the DVR. For a list of approved DVR antennas, please refer to **Appendix 12.**

IMPORTANT!
To assure optimum performance and compliance with RF Energy Safety standards, these antenna installation guidelines are limited to metal-body vehicles with appropriate ground planes and take into account the potential exposure of back seat passengers and bystanders outside the vehicle.

The MSU and DVR antennas must be installed in such way as not to cause interference.

IMPORTANT!
All DVRS models require 30dB minimum Antenna Isolation between the DVR and MSU Antennas.

Before installing an antenna on the trunk lid:

- Ensure the distance from the antenna to the front surface of the rear back seat is greater than the minimum distance specified in the “Product and RF Safety” booklet for the specific DVRS model and frequency band.
- Ensure the trunk lid is grounded by connecting grounding straps between the trunk lid and the vehicle chassis.

To ensure compliance with RF Energy Safety standards, the antenna locations, gain and maximum transmit power (for both the MSU and the DVR) must be as specified in the “Product and RF Safety” Booklet shipped with the DVR.

NOTE:
The DVRS antenna ports are mini UHF female and require antennas with matching mini UHF male terminations. Simplex ONLY DVRS configurations feature TNC female connector on the DVR side.

Index

Part II – DVRS PROGRAMMING

LIST OF TABLES

DVR Programming Basics

Installing and Uninstalling the Tweaker Programming Software

Operating Systems	Windows XP Windows 7
Processor	400MHz or higher Pentium grade processor
Peripherals	CD Drive for software installation USB Port

If you have older Tweaker version already installed, you can either uninstall it first OR you can simply install the new Tweaker in a new folder.

Insert the provided CD in your PC's CD/DVD drive and follow the prompts to install the Tweaker programming software in the desired location on your PC. If the installation does not start automatically, please open the provided CD and click on the Setup.exe file.
To uninstall Tweaker – go to the Control Panel, Add and Remove Programs, find the DVRS Tweaker and select the Remove option.

Using the Tweaker Programming Software Off-Line

The Tweaker programming software can be used off-line to review, modify and save new personality templates (.dpd) files.

Viewing DVR Personality Files Off-Line

Run the Tweaker.
Select ***File → DPD Files (Templates) → Load DPD File*** and specify the dpd file location and name when prompted.

Modifying DVR Personality Files Off-Line

Once a dpd file is successfully opened (as described in the previous section), the dpd settings are available for reviewing and modification off-line.

Saving DVR Personality Files Off-Line

After editing the personality setting, the dpd file can be saved by selecting ***File → DPD Files (Templates) → Save DPD File*** and specifying a new or the same dpd file name and location.

Using the Tweaker Programming Software On-Line

To use the Tweaker on-line the following is required:

1. Tweaker software installed on the PC.
2. Powered up DVRS.
3. Programming cable (USB cable directly connected to the DVR or Motorola programming cable connected to the MSU control head).

Setting up Communications with the DVR

1. Ensure the USB cable is plugged into your PC and connected to the USB port on the DVR.
2. Ensure the DVRS is powered up. Note that the DVR may be connected to DC power but will power up only when the MSU interfaced to it is powered up.
3. If connecting to the MSU control head IP Ethernet port, ensure the 'Connect to Control Head' field on the Ports screen in Tweaker is set to 'Yes'.

Ports

Field Name	Range	Description	Notes
COM Port	na	Automatically selected and used when connecting directly to the DVR USB Port.	
Connect to Control Head	Yes No	Set to 'Yes' when PC is connected to the MSU Control head IP Ethernet port. Set to 'No' when connecting directly to the DVR USB Port.	Default setting is 'No'
MSU IP	Read Only	Applicable only when connecting to the MSU Control Head.	
DVRS IP	Read Only	Applicable only when connecting to the MSU Control Head.	
DVRS Port	Read Only	Automatically assigned field.	
Programming Mode for MSU	Yes No	When set to 'Yes' the MSU is placed into programming mode whenever the DVR is being programmed. When set to 'No' the MSU is still fully functional while the DVR is being programmed.	Default and recommended setting is 'Yes'.

Reading the DVR Electronic Label

The Electronic Label of the DVR contains information regarding the firmware currently loaded in the DVR, the hardware model and serial number.
To read the DVR Electronic Label, select ***DVR Info*** from the ***Repeater Setup Menu***:

The electronic label can be read either on-line or by loading a previously saved .epr or .dpd file.

NOTE:
An .epr file contains the personality and calibration data of a specific DVR unit. A .dpd file contains the personality settings of a DVR unit. Used for 'cloning'.

The Electronic Label is also stored in the .dpd file, even though the information contained in it does not overwrite the electronic labels of the DVRs during 'cloning'.

Reading from the DVR (Uploading Data)

To read a DVR unit:

1. Establish On-Line communication with the DVR.
2. Select ***Repeater → Load Data from Repeater*** OR Press **F2**.
3. The personality data of the currently connected DVR unit will be loaded into the Tweaker memory for reviewing and / or editing.

Writing to the DVR (Downloading Data)

Applying dpd File ('Cloning')

Select ***File → DPD Files (Templates) → Apply DPD to The Repeater.*** Specify the desired .dpd file name and location when prompted.

Writing Selected Changes to the DVR

If any changes are made while reviewing the personality data of a DVR (On-Line), the fields containing changes are shaded in green (if the changes are valid). If the changes are not valid, the fields will be marked red and the new settings cannot be saved to the repeater.
After making the necessary changes to all the settings on the various Tweaker screens, the new personality can be saved to the DVR by executing any of the following:

- ***F4***
- OR
- ***Repeater → Save Changes to Repeater***
- OR
- ***Repeater → EEPROM Maintenance (Ctrl+E) → Changes ->Repeater***
- OR
- Click on the EEPROM Maintenance Icon → ***Changes -> Repeater***

Reset the repeater (after the changes are saved) in order to ensure the changes are in effect. Resetting of the DVR can be done by executing any of the following methods:

- ***Repeater → Reset Repeater***
- OR
- ***F3***
- OR
- ***EEPROM Maintenance → Reset Repeater***
- OR
- Power OFF and ON the MSU

When the DVR personality has been changed and the changes are not causing any detected errors, the EEprom maintenance icon is flashing yellow. Clicking on the icon opens the EEprom screen which offers the options of saving the changes to the DVR and resetting the DVR. If the data changes contain errors, the EEprom icon is flashing red and the screens containing conflicting data will be marked with a red exclamation mark. In this case, the changes cannot be written to the DVR EEPROM until the errors are eliminated.

DVRS Programming Guidelines

Programming Steps Overview

The DVRS operation depends on the following:

- DVR firmware and programming settings
- MSU firmware and programmed personality
- PSU type, firmware and programmed personality
- System infrastructure

To enable a given DVR feature, all of the above components must be adequately setup and matched to support it.

IMPORTANT!
Changes to any of the personality templates may require corresponding adjustments to the personality templates of the rest of the system components.

To ensure consistent programming of all components, the following programming sequence is recommended:

Step	Action	Software Program Used
1	Create the MSU template with enabled DVR Operation and save it. Ensure the desired MSU Talk Groups / modes are set to 'DVRS Enabled' and there are no frequency plan issues (In-Band models only).	**Mobile CPS (Motorola)**
2	Export an .xml file by using the "DVRS Export" option in the Motorola CPS (Codeplug Menu). Save the xml file on your PC.	**Mobile CPS (Motorola)**
3	Create a .dpd file and program the licensed DVR channels. Ensure the DVR frequencies are within the ordered filtering specification.	**Tweaker (Futurecom)**
4	Import the saved .xml file.	**Tweaker (Futurecom)**
5	Program the Mobile Channel attributes as required.	**Tweaker (Futurecom)**
6	Program the desired analog / digital mode features in the DVR.	**Tweaker (Futurecom)**
7	Save the .dpd template.	**Tweaker (Futurecom)**
8	Create the PSU template. Ensure DVR Operation is Enabled and the settings match those programmed in the DVRS.	**Portable Radio CPS (Motorola)**
9	Save the PSU codeplug.	**Portable Radio CPS (Motorola)**
10	**Ensure all personality templates are matched in terms of frequencies, PL/DPL, TX/RX NIDs, enabled and disabled features etc. and confirm through testing the DVRS operation before field deployment.**	

Table 1 Recommended Programming Sequence

Programming the APX MSU for DVRS Operation

Enabling the DVR in the APX MSU

When interfacing a DVR to an APX MSU, the 'DVRS Hardware Enable' option must be enabled (**DVRS Configuration → DVRS Wide → General → 'DVRS Hardware Enable'**).
DVRS Operation can then be enabled in the desired MSU conventional and / or trunked personalities by selecting corresponding 'DVRS Profile Selection' (**Trunking Personality 'X' → General → 'DVRS Profile Selection'**; **Conventional Personality 'Y' → General → 'DVRS Profile Selection'**).

NOTE:
The MSU requires H-Option **GA00631AA** in order to support DVRS operation.

DVRS Button Assignment

To be able to control and change the DVR mode and channel from the MSU control head, a DVRS button must be programmed in the MSU (**Radio Ergonomics Configuration →Controls → Menu Items**). The 'DVRS' button function can also be assigned to a side button on the keypad microphone.

Automated VR Activation (AVRA) Programming in the APX MSU

The DVR can be automatically activated by external logic (car door switch, park brake switch, portable charger etc) wired to a dedicated MSU VIP Input. The MSU VIP Input assigned for the AVRA function is specified in the **Radio Ergonomics Configuration →Controls → Radio VIPs → General** menu.

NOTE:
The DVR must be programmed for VIP type activation by checking the Hardware Setup → **'AVRA uses VIP on CH'** in the DVRS Tweaker.

In Car Monitor (ICM) Programming of the APX MSU

The ICM function can be programmed to be either **'HUB Controlled'** or **'ICM Button / Menu Controlled**' in the **DVRS Configuration → DVRS Wide → General** menu of the APX MSU codeplug. If **'ICM Button / Menu Controlled**' option is selected then the corresponding ICM button / Menu item needs to be programmed as well. In addition, ICM operation (Enabled or Disabled) needs to be programmed for each DVRS Profile by checking / unchecking the **'ICM Allowed'** box (**DVRS Configuration → DVRS Profiles → Profile 'X' → General**).

DVRS Profile Settings Programmable in the APX MSU

The following features are programmed in the corresponding DVRS Profiles in the APX MSU:

MSU Field Name	Options/Units	Description	Notes
DVRS Profile Name	Name	Desired Profile Name	
DVRS Remote Activation	'Disabled' 'Via Call Alert'	'Disabled': Call Alerts from the FNE addressed to the MSU's Radio ID are handled in the same way that a regular Call Alert is handled. 'Via Call Alert': Call Alerts from the FNE addressed to the MSU's Radio ID cause the DVR to cycle through its Modes: System, Local and Off.	When this feature is Enabled, the MSU can no longer initiate or receive a regular Call Alert.
Generate Status on DVRS Mode Change	Enable / Disable Check Box	Enables / Disables the MSU sending Status message to the FNE to indicate the current DVRS mode after EVERY DVR mode change regardless of the trigger (CH button or remote change by PSU or by FNE).	The MSU sends the following Status updates when this feature is Enabled: Status 1 = OFF Status 2 = LOCAL Status 3 = SYSTEM When enabled the MSU can't generate any other Status messages.
ICM Allowed	Enable / Disable Check Box	Enables / Disables the In Car Monitor Functionality for a given DVR Personality	Refer to the **Global DVRS Features** Section of this document for details on ICM operation.

MSU Field Name	Options/Units	Description	Notes
Local Mode – Outbound System Repeat in Local Mode	Enable / Disable Check Box	When the DVRS is in the LOCAL mode, this setting determines if outbound system calls are transmitted by the DVR to the Local PSUs (when Enabled) or not (when Disabled).	
Local Mode – MSU System PTT in Local Mode	Enable / Disable Check Box	If Enabled, the MSU is keyed up upon MSU MIC PTT even if the DVR is in the Local Mode. When Disabled, only the DVR is keyed up when the MSU MIC is PTT-ed.	When this setting is Disabled, the System Mode – Local Tx Fallback field is accessible. This field can be enabled ONLY when the **Local Mode – Outbound System Repeat in Local Mode** is Enabled. When this setting is Enabled, the System Mode – Local Tx Fallback field can't be enabled.
System Mode – Local Tx Fallback	Enable / Disable Check Box	If upon MSU MIC PTT the MSU can't transmit to the FNE then if this field is enabled, the MSU MIC audio will be routed and transmitted locally by the DVR only. If Disabled, the MSU will sound deny ergonomics until the MSU can transmit to the FNE.	The local transmit is not supported in the case of Trunked FNE busy, conventional smart PTT and secure key mismatch / secure key errors.

MSU Field Name	Options/Units	Description	Notes
Proxy Time Out Timer (sec)	15 sec to Infinite in 15 seconds increments	Selects the amount of time that the MSU is able to transmit a "proxied" audio call, in other words, continuous group voice or individual voice audio from a PSU (via the DVRS) to the FNE system.	Infinite indicates that no timeout occurs regardless of the duration of the PSU call.
Proxy Limited Patience (sec)	1 sec – 60 secs	Selects the amount of time that the MSU waits for a busy Conventional channel to become available for a PSU (Proxy) transmission request before failing the transmission.	Applies specifically to proxy signaling transmissions, such as status, message. call alert etc.

P25 Trunking OTAR via DVRS

In order for the DVRS MSU to provide packet data services to associated PSUs on a P25 Trunking system, the MSU must be configured for packet data operation and must be context activated on the system.

MSU Scan Programming Requirements

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
- Mixed Conventional Voting Scan
- Legacy Voting Scan

The MSU does not support any other modes of scan operation, apart from those listed above, while the DVRS operates in SYSTEM or LOCAL mode. In such unsupported cases, the MSU will automatically suspend scan operation when the DVRS is set to SYSTEM or LOCAL mode of operation and resume it when the DVRS is OFF.

Exporting MSU data (.xml file)

Once the MSU is programmed for DVRS operation, the data needs to be exported by using the Motorola CPS “DVRS Export” option in the Codeplug menu. The standard CPS Export Data option cannot be used for DVRS programming purposes.

Programming the PSUs for DVRS Operation

The programming of the PSU depends on the PSU type and user requirements. The following paragraph describes the programming options related to DVRS operation for the 3 main types of PSUs – Analog, P25 Digital (Generic), P25 DVRS Enabled.

The following PSU models have modified firmware that allows them to operate as DVRS Enabled:

PSU Models that can be 'DVRS Enabled'	PSU Firmware Revision Required
XTS1500 XTS2500 XTS5000	R9.00.00 and later ***Note: It is highly recommended to always use the latest released PSU firmware to ensure all fixes and new features are included.***
APX4000 APX6000 APX7000	R7.00.05 and later ***Note: It is highly recommended to always use the latest released PSU firmware to ensure all fixes and new features are included.*** APX portable radios operating through a DVR, utilizing the enhanced DVR digital feature set require subscriber option **QA00631**.

Table 2 DVRS Enabled PSU Models

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

NOTE:
XTL and APX MSUs can also be programmed as 'DVRS Enabled' and used to communicate through a DVRS provided they are NOT interfaced to a DVRS.

Programming the P25 'DVRS Enabled' PSU

The P25 DVRS Enabled PSU needs to be affiliated on the P25 FNE through the DVRS therefore its ASTRO Unit ID and TG ID must be valid and allowed on the FNE side.
Typically the conventional ASTRO PSU Unit ID is set to match that of the trunking system PSU ID in in-band applications. In cross-band application the ASTRO PSU unit ID must be enabled in the P25 system in order to be able to affiliate and communicated through the DVRS.

If **Fireground (FG)** signaling is enabled in the PSU, ensure that the programmed **"Tx Voice Type"** (analog or digital) matches the type of corresponding DVR "FG Enabled" channel (analog or digital).

Remote Talk Group Steering allows local PSU user to remotely change the TG / channel currently selected on the MSU by sending a call alert / page to the DVR (using the DVR ID) and transmitting a specific NID.

If **Remote Talk Group Steering** is required, the PSU must be programmed to transmit on the same DVR channel with different NIDs, which NIDs are then strapped to the desired MSU modes in the Tweaker Mobile Radio Channel Setup screen.
When the DVR receives a call alert page with given NID, it steers the MSU to the mode associated with this NID. The DVR Tx NID is as programmed and must be matched with the PSU Rx NID! The PSU is programmed with various Transmit NIDs (used for the steering) but the same Receive NID (or F7E). The DVR Rx NID is programmed to match the PSU Tx NID programming when no remote mode steering is needed.

XTS Series 'DVRS Enabled' PSUs

If the XTS 'DVRS Enabled' PSU needs to support say 10 TGs via DVRS, then the PSU needs to be programmed with 10 different conventional ASTRO personalities using the designated DVRS Enabled ASTRO system. Each conventional personality must be strapped to the corresponding TG ID from the specified TG List. Each conventional personality is then assigned to a desired PSU mode in the Zone / Channel assignment listing. The PSU behavior, when switched to a DVR channel, is specified by programming the desired features in the corresponding ASTRO system 'DVRS' Tab. Alternatively the PSU can be programmed with just one (or a few TG IDs) and **TG translation** can be enabled in the DVR so that the PSU TG ID is always translated to the ID of the TG selected on the MSU control head.

NOTE:
TG IDs are programmed in the XTS PSU conventional ASTRO Talk Group List in decimal format.

APX Series 'DVRS Enabled' PSUs

If the APX 'DVRS Enabled' PSU needs to support say 10 TGs via the DVRS, then the PSU may be programmed with a single Conventional Personality, which is using a Conventional System of 'DVRS' type. The Conventional Personality's Frequency Option table will contain 10 entries, which are strapped to desired TG IDs. The actual TG IDs are specified in the designated Astro Talk Group List, which is then linked to the Conventional Personality ('Astro Talkgroup' tab). The PSU behavior, when switched to a DVR channel, is specified by programming the desired features in the corresponding Conventional System 'DVRS' Tab. Each Frequency option of the Conventional Personality (using desired TG ID and a 'DVRS' type Conventional System) is then assigned to a PSU mode in the Zone Channel Assignment listing. Alternatively the PSU can be programmed with just one (or a few TG IDs) and **TG translation** can be enabled in the DVR so that the PSU TG ID is always translated to the ID of the TG selected on the MSU Control Head.

Programming of Generic P25 PSU for Digital DVRS Mode

The programming of a Generic P25 PSU requires matched DVR – PSU programming of:

- DVR Tx and Rx Frequencies
- Tx and Rx NIDs (NACs)

In addition, the programmed PSU ASTRO Unit ID and selected TG ID must be valid and allowed on the P25 system.

Programming of the P25 PSU (Generic P25 or DVRS enabled) for operation on Conventional P25 MSU System

Both PSU types must have the Tx and Rx NIDs matched with those programmed in the DVR. If the P25 conventional system is not using dedicated TG IDs then all system radios transmit with the default TG ID = 1.
When the XTS PSU is programmed as 'DVRS Enabled', and 'Talkgroup' is checked in the given conventional personality, the PSU transmits with default TG ID = 2. When the system radios are operating on a conventional P25 system, which is not using Talkgroups, all radios still transmit with default TG ID = 1. Therefore the DVRS Enabled XTS PSU programming may need to be changed to TG ID=1 in order to match the rest of the system radios so that communications can be heard between DVRS PSUs and system PSUs. The Generic P25 PSU transmits with default TG ID = 1 so it matches the rest of the system radios and its programming does not need to be changed.

NOTE:
TG ID 1 can be added to the DVRS Translation tables so that PSU calls coming from Generic P25 PSUs (with TG ID 1) will be translated to the TG ID currently selected on the MSU, while 'DVRS Enabled' PSUs will be able to make proxied calls on their selected TG IDs.

If the conventional P25 system is using dedicated TG IDs, then the 'DVRS Enabled' or Generic P25 PSU must be programmed with corresponding conventional personalities using the required TG IDs.

Programming of the P25 XTS PSU (Generic P25 or DVRS enabled) for Inbound Digital Takeover

A Generic P25 XTS PSU must have Smart PTT disabled if "Outbound Takeover by Voice Allowed" is enabled in the DVR.

Programming of Analog Conventional PSU for Analog DVRS Mode

The programming of any PSU for analog mode involves the following:

- PSU Tx frequency and Tx PL/DPL must match the DVR Rx frequency and Rx PL/DPL.
- PSU Rx frequency and Rx PL/DPL must match the DVR Tx frequency and Tx PL/DPL.
- Adjacent channel spacing programming of the DVR channel and PSU must be the same i.e. either 12.5kHz or 25kHz.
- If MDC Emergency is to be used by the PSU, the PSU must have MDC1200 signaling enabled. The MDC1200 System Pretime must be set to 50ms if the PSU Emergency ID is to be seen on other System radios that are on the same TG. If the MSU has the default System Pretime of 700ms, the PSU Emergency ID will only be displayed on the Dispatcher Console.
- **Preamble during pretime must NOT be enabled.**
- If MDC1200 Emergency alarm is to be used when the MSU is on a trunked channels, the MDC ID (hex) must be allowed on the Trunking system side.
- If DTMF signaling is used, the DTMF sequence programmed in the PSU must end with a ‘*’ i.e. 123*.

DVR Programming

The following paragraphs provide detailed DVR programming information.

IMPORTANT!
Do not change DVR settings unless fully familiar with the meaning of a specific option. The Tweaker program reports any obvious errors and does not allow invalid data to be saved to the DVR, however, not all inconsistencies can be reported by the Tweaker. Successful DVRS programming requires thorough understanding of the DVR, MSU and PSU programming as well as the specific User / System requirements. Only when all templates (DVR, MSU and PSU) are matched, the DVRS will operate properly. For instance, changing the APX MSU template may require corresponding update of the DVR template, which in turn may require update of the PSU template.

Repeater Setup

RF/Analog Setup

The values in this menu are set to the correct settings upon shipping from the Futurecom factory. No changes to those values are required unless instructed otherwise by Futurecom.

Frequency Band Setup

This screen is used for selecting the adjacent channel separation. Two selections are possible – Set 1 and Set 2, which can be either Narrowband (12.5kHz) or Wideband (25kHz). Ensure the correct spacing (Set 1 or Set 2) is selected to match the portable radio programming on each DVR channel – see “Repeater Channel Setup” screen, ‘Bandwidth’ field.

User Text

This screen is provided for template maintenance purposes. The DVR personality templates can be dated and referenced from this Menu screen by entering an applicable template / project description and revision.

DVR Info

This screen is for information only and it displays the firmware revisions, model and serial number of the DVR.

Personality Data Setup

Repeater Channel Setup Menu

Field Name	Options / Units	Description	Notes
Ch #	1-192	DVR Channel Number – referenced in the Mobile Radio Channel Setup when associating DVR channels to Mobile Radio Modes.	Read Only Field.
Name	Seven (7) character string	DVR Channel name (alias) displayed on the Control Head when the DVR is enabled.	
Channel Mode	F. Duplex Simplex	Determines the DVR mode of operation for the specific channel – Full Duplex or Simplex.	
Fire Ground	Yes / No	Enables or Disables Fireground Signalling Capabilities on the selected DVR channel.	Fireground (FG) signaling can be enabled on analog or digital DVR channels only.
Channel Type	Digital Analog Mixed F.Analog TPS	Defines the DVR Channel Type. Mixed Mode is selected when the same DVR channel will be used by Analog and P25 PSUs.	
Rx Freq	[MHz]	DVR Rx Frequency (Must match the PSU Tx Frequency).	
Rx PL	[Hz] / DPL	DVR Rx PL / DPL (Must match the Analog PSU Tx PL/DPL).	Applies to Analog, Mixed and F. Analog Mode Only.
Tx Freq	[MHz]	DVR Tx Frequency (Must match the PSU Rx Frequency).	
Tx PL	[Hz] / DPL	DVR Tx PL / DPL (Must match the Analog PSU Rx PL/DPL).	Applies to Analog, Mixed and F. Analog Mode Only.
PL STE	[deg] / DPL	Analog PSU PL/DPL Squelch Tail Elimination – must be programmed to match the PSU.	Applies to Analog, Mixed and F. Analog Mode Only.
VR Mode	System Local User	Determines the Default DVR mode when this DVR channel is selected. TG Mode (Mobile Radio Channel Setup) overwrites this setting.	
Manual Mode Change	Enabled Disabled	Enables / Disables the DVR mode change from the VRS button on the Control Head. If this field is set to Disabled, the VRS button still toggles between the default DVR mode and OFF mode.	This field is automatically set to Enabled when the VR Mode is set to User.
Tx Pwr	30-40 dBm	Specifies the selected Tx Output Power at the DVR Antenna Port on the DVR Tx frequency.	The Duplexer Tx Insertion Losses as entered in the **Interface to Mobile Setup** screen are compensated by the DVR PA Output to produce the programmed Tx Power at the Antenna Port.

Field Name	Options / Units	Description	Notes
R-Tx Pwr	30-39 dBm	Specifies the selected Tx Output Power at the DVR Antenna Port when the DVR transmits on its Rx frequency to other DVRs. Refer to the **Primary /Secondary Operation** Paragraph for more details.	The Duplexer Rx Insertion Losses as entered in the **Interface to Mobile Setup** screen are compensated by the DVR PA Output to produce the programmed Tx Power at the Antenna Port.
CCT	0-60 min	Continuous Carrier Timer – specifies the maximum time a DVR can be transmitting before its Tx function is disabled. If the CCT is set to 0 (OFF), the DVR operates in continuous duty mode.	Does not affect Telephone Interconnect Calls. Phone calls have a separate CTT programmed in the Digital System Setup.
ON/OFF Trigger	RSSI Squelch Sq&RSSI	Analog Mode – any ON/OFF trigger can be selected. Digital Mode – RSSI only allowed. Mixed Mode – RSSI only allowed.	Squelch is invalid setting in Digital, F. Analog or Mixed Mode DVR Channels.
RSSI Thresh	-50 to -127dBm	Default Setting is -115dBm.	The Duplexer Rx Insertion Losses as entered in the **Interface to Mobile Setup** screen are taken into account to calculate the RSSI at the Antenna Port.
Busy Lc Th	-65 to -105 dBm	Threshold used during the dynamic Busy Lockout Phase if **Primary / Secondary Enable BL for Voice Comm** is enabled (see **Digital Mode Settings** menu).	Refer to the **Primary /Secondary Operation** Paragraph for more details.
Rx NID (h)	Hex #	Must match the P25 PSU Tx NID. Serves as CAS validation in Digital Mode (equivalent to Rx PL/DPL in Analog Mode). **F7E Enables the DVR to receive on any NID.**	Applies to Digital, Mixed and F.Analog Mode.
Tx NID (h)	Hex #	Must match the P25 PSU Rx NID. Serves as CAS validation in Digital Mode (equivalent to Tx PL/DPL in Analog Mode).	Applies to Digital, Mixed and F.Analog Mode.
Tx RSSI Th	-60 to -110dBm	When a Secondary DVR detects a request for DVR repeat and it does not detect any Heart Beats coming from the current Primary DVR, the Secondary DVR checks for activity on its Tx frequency (exceeding the Tx RSSI Th) to determine if the lack of Heart Beat is due to the Primary DVR already repeating the Call. If no activity is found to exceed the **Tx RSSI Th** the DVR will check again and if 3 heart beats are missed, the DVR will negotiate becoming a Primary.	Refer to the **Primary /Secondary Operation** Paragraph for more details.

Field Name	Options / Units	Description	Notes
Rx RSSI Th	-60 to -110dBm	The DVRs exchange Primary/Secondary messages on their Rx frequency while idle. Before a Primary DVR sends out a Primary Heart Beat (HB), it checks for RF activity and HB exceeding the programmed 'Rx RSSI Th' on the Rx frequency. If the Primary DVR does not detect any RF activity or HB exceeding the 'Rx RSSI Th', it will proceed with sending a Primary HB. If it detects HB exceeding the programmed 'RX RSSI Th', the Primary DVR backs off and becomes non-Primary, on stand-by. If a HB is detected but its level is below the programmed 'Rx RSSI Th' the DVR will stay a Primary and send its HB. If it detects RF activity on the Rx frequency, the Primary DVR will postpone the sending of its HB until the Rx frequency is clear to ensure the HB can be successfully (without interference) received by the other DVRS.	Refer to the **Primary /Secondary Operation** Paragraph for more details.
Bandwidth	Set 1 Set 2	Selects the Adjacent channel spacing (12.5kHz or 25KHz) as programmed in the 'Frequency Band Setup' menu.	See **'Frequency Band Setup'** Screen.
Steering	Yes No	Enables ('Yes') or Disables ('No') portable initiated steering of the MSU mode (zone/channel). Based on the PL/DPL programmed in the PSU and received by the DVR. The DVR steers the MSU to the zone/channel that is associated with a specific Rx PL/DPL programmed in the DVR **Steering Table**.	Applicable to Analog DVR Modes only.
Steering Table	screen	Opens a steering Table that enables the user to program up to 14 different mobile modes per DVR channel and the corresponding Rx PL/DPL codes that are used as steering triggers. When the DVR receives a LPSU transmission with the programmed PL/DPL, it will steer the MSU to the corresponding MSU mode.	Applicable to Analog DVR Modes only.

Field Name	Options / Units	Description	Notes
Steering in Emergency	Yes No	Default setting is 'No' (Disabled). When steering in emergency is Disabled, the DVR suspend steering until the emergency is cleared. The DVR disregards the programmed RX PL/DPL and repeats all traffic to the System. If enabled (set to 'Yes') the VR steering does not change when emergency has been declared.	Applicable to Analog DVR Modes only.
Steering Revert	Yes No	Enables ('Yes') or Disables ('No") MSU revert to the originally selected zone/channel after the steering inbound call is complete and the **Steering Hang Timer** has expired.	Applicable to Analog DVR Modes only.

Mobile Radio Channel Setup

The DVR operation may be enabled on some MSU modes and disabled on others as selected and programmed in the personality of the MSU interfaced to the DVR.
The DVR must be 'made aware' as to which TGs are 'DVR Enabled' and which are 'DVR Disabled'. The DVR can be used only on the MSU modes listed in the Mobile Radio Channel Setup screen accessible via Tweaker. The Mobile Radio Channel Setup data is extracted by first exporting the MSU data (using the Motorola CPS) and then importing the data by using the ***Import → Motorola XML*** function of the Tweaker as described in the next paragraph.

Importing Motorola XML File

After programming the APX6500 / APX7500 for DVRS operation and exporting the XML file using the Motorola CPS, the data needs to be imported into the DVR by using the ***Import → Motorola XML file*** function of the Tweaker. Any change to the MSU programming may require exporting and importing of a new XML file in order to update the DVR programming personality to match that of the MSU.

Configuring the Mobile Radio Channel Settings in the DVR

Field Name	Range	Description	Notes
Zone #	Read Only	This field is extracted during the **"Import Motorola XML File"** process.	
Ch. #	Read Only	This field is extracted during the **"Import Motorola XML File"** process.	
Name	Read Only	This field is extracted during the **"Import Motorola XML File"** process.	
Pers. Type	Read Only	This field is extracted during the **"Import Motorola XML File"** process.	
TG #	Read Only	This field is extracted during the **"Import Motorola XML File"** process.	
Emergency Revert	Read Only	This field is extracted during the "Import Motorola XML File" process.	This field will be marked red (invalid) if it: • Points to MSU channel, which TG Mode is "Disabled" • Points to a 'VR Disabled' zone and channel • Points to an MSU channel, which does not have the current VR channel in the list of allowed VR channels

Field Name	Range	Description	Notes
Emergency Rev Item #	Item # (on the same screen)	The correct Emergency Revert MSU Mode referenced by its Item # must be programmed to indicate which mode the MSU must revert to and issue the PSU emergency on. **Important: Specifying an incorrect Item # in this field may result in the loss of Emergency and subsequent Emergency communications!** **Entering '0' in this field is equivalent to 'No revert'.**	Applicable to non-proxied P25 PSU operation (such as during TG translation), analog PSU or Forced Analog PSU operation when the selected MSU mode is Type 2 Trunked or P25 Trunked (FDMA or TDMA). This field will be marked red (invalid) if it: • Points to zone entry • Points to MSU channel, which has 'TG Mode' programmed as "Disabled" • Points to value that is greater than Num. of Items • Points to an MSU channel, which does not have proper set of VR channels in the list of allowed VR channels (Emergency Revert MSU channel must have all VR channels that the originating MSU channel has)
Emergency ACK type	'VR ACK' 'Site ACK' 'Console ACK' 'Uncond. VR ACK'	If set to 'VR ACK' – emergency sent by the local PSU and received by the DVR is immediately acknowledged by the DVR. The DVR sends ACK to the PSU only after FNE Site ACK or RCM ACK when this field is set to 'Site ACK' or 'Console ACK' respectively. When 'Uncond. VR Ack' is selected and the MSU is Out of Range, the DVR is unable to transmit the Emergency Alarm and the DVR will send an ACK to the PSU to stop the subsequent emergency retries.	Applicable only when the 'Portable Ack Rq' field on the Emergency Mode Setup screen is enabled (checked).
Steer NID (h)	Hex number	Hex number used for remote change of MSU TG/channel. Must match the NID programmed in the PSU.	Refer to the **"Remote DVR Control / TG Steering"** Paragraph.
VRch	number	If **Independent Channel Change** is Disabled (i.e. DVR Ch Strapping is enabled), this field determines which DVR Channel will be automatically selected upon selection of the specified Mobile Radio Mode (TG or Channel).	'Strapping' is Enabled / Disabled by the **Independent Channel Change** Field in the **DVR Common Setup** Menu.

Field Name	Range	Description	Notes
TG Mode	None Local System User Disabled OFF	Enables or Disables Slaving of the DVR Mode to the selected TG. **'None'** → this selection assumes no specific DVR Mode is linked to the TG. The DVR stays in the last mode or the Mode associated with the DVR Channel. **'Local' / 'System'** → This selection forces the DVR Mode to change to either Local or System respectively upon selection of the TG. **'User'** → The Last DVR Mode that was selected by the User is in effect and the User can change it as required. **'Disabled'** → DVR is Disabled when this TG is selected. **'OFF'** → DVR is in OFF mode when this TG is selected.	The **'Disabled'** setting must be selected in case of multi frequency band MSU modes (trunked or conventional) when band locking is enabled (i.e. no in-band filters are installed). In such case, if a different TG Mode is selected, the Tweaker TG Mode field will be red and the personality can't be saved in the DVRS.
Manual Mode Chg	Enabled Disabled	Enables or Disables the Mode change (SYS / LOC) via the VRS button when a specific TG is selected.	
VR Ch All Alwd	Yes / No	This field specifies if the User can select from any programmed DVR channel or from a short list. If Strapping is Enabled, the DVR will steer to the programmed strapped DVR channel, yet the User may still be able to select a different channel if more then one entries are enabled in the 'VR Ch List'.	
VR Ch List	0 - max # of programmed DVR channels	Enables the selection of which DVR channels are selectable when a specific MSU TG / Channel is selected on the MSU CH.	Applicable only if the **"VR Ch All Alwd"** field is set to "No".
RCM (hex)	Read Only	This field is extracted during the **"Import Motorola XML File"** process.	
PTT ID	Enabled Disabled	Enables or Disables the pass through of the PSU PTT ID through the DVRS.	Applies to analog mode (MDC PTT ID).
Sys Repeat	Read Only	This field is extracted during the **"Import Motorola XML File"** process.	
Non ASTRO Sign	Read Only	This field is extracted during the **"Import Motorola XML File"** process.	
Freq Band	Read Only	This field is extracted during the "Import Motorola XML File" process.	
TDMA X2	Read Only	This field is extracted during the "Import Motorola XML File" process.	Refers to X2 type of TDMA MSU Mode.
TDMA Ph2	Read Only	This field is extracted during the "Import Motorola XML File" process.	Refers to Phase 2 type of TDMA MSU Mode

Field Name	Range	Description	Notes
P25 Trunking System	MSI	'MSI'_ Default. The DVR/VRX sends the 'Status' received from the P25 PSU to the MSU without any change.	Applicable only to P25 Trunking Channels.
	Non MSI 1	'Non MSI 1' The DVR/VRX adds 1 to 'Status' received from the P25 PSU and forwards the incremented 'Status' to the MSU.	
	Non MSI 2	'Non MSI 2' reserved for future use	
	Non MSI 3	'Non MSI 3' reserved for future use	

Hardware Setup Menu

Field Name	Range	Description	Notes
RSSI OFF Hysteresis	2-20dB	Sets the RSSI CAS OFF threshold in dB below the RSSI CAS ON Threshold (see **Repeater Channel Setup** Menu).	Typically set to 5dB.
Speed	1-10ms	Sets the RSSI Averaging Integration Time.	Typically set to 2ms.
Squelch ON Threshold OFF Threshold	4-28dB 3-25dB	Sets the Squelch ON and OFF thresholds.	Affects Analog Mode only. Typical recommended settings are ON: 16dB SINAD OFF: 10dB SINAD.
Speed	10-150ms	Squelch Averaging Integration Time.	Typical setting is 25ms.
Reptr FM Dev. Limit **12.5kHz** **25kHz**	 0.75–2.5kHz 1.5 - 5kHz	Typically set to 2.12kHz (12.5kHz channel spacing) or 4.25kHz (25kHz channel spacing.	Affects Analog Mode only. Depends on the selected Channel Spacing – refer to the **Frequency Band Setup** menu.
PL FM Deviation **12.5kHz** **25kHz**	 0.19-0.75kHz 0.38-1.5kHz	Typically set to 0.38kHz (12.5kHz channel spacing) or 0.75kHz (25kHz channel spacing.	Affects Analog Mode only. Depends on the selected Channel Spacing – refer to the **Frequency Band Setup** menu.
PL STE Delay	120-250ms	PL Squelch Tail Elimination Delay. Must be set to match the portable setting. Typical setting is 150ms.	Affects Analog Mode only. If this field is programmed too short the squelch tail will not be fully eliminated. If it is programmed too long, the portable may unmute unnecessarily.
Automatic VR Activation (AVRA)	Enable / Disable check box	Enables or Disables the Automated VR Activation (AVRA) Option.	

Field Name	Range	Description	Notes
AVRA Function	Activate Only Activate / Deactivate Toggle	If AVRA is Enabled then this field can be set to one of the following: **'Activate Only'** → Once the DVR is ON it can not be switched OFF via the AVRA trigger. It can only be switched OFF from the MSU CH. **'Activate / Deactivate'** → If the AVRA trigger is de-asserted, the DVR automatically switches ON or OFF. **'Toggle'** → The DVR is switched OFF every second time the AVRA trigger is asserted.	Only applicable if AVRA is Enabled. The **'Activate / Deactivate'** setting is typically used when the AVRA trigger is a Portable charger. Removing the portable from the charger switches the DVR ON (System Mode). Placing the Portable back in the charger switches the DVR OFF. The **'Toggle'** setting is typically used when the AVRA trigger is a car door switch. Closing the door the first time does not deactivate the DVR.
AVRA uses VIP on CH	Enable / Disable check box	This field must be set to Enabled when the AVRA trigger is wired up to a VIP I/P on the Mobile Radio Control Head or DEK.	
AVRA Activation Tone	Enabled or Disabled	This option enables or disables the 'beep' heard on the MSU speaker upon DVRS mode change when triggered by AVRA.	The same 'beep' is heard when the DVRS mode is changed by pressing the VRS button on the control head.
DVR AVRA Polarity	Active High Active Low	Defines the DVR ON/OFF trigger polarity when an external switch is wired to pin 1 of the DB15 connector on the DVR Auxiliary cable (7W083X06-01).	Applicable when the DVR ON/OFF activation trigger is wired to the DVR Auxiliary cable. **Not applicable when the DVR ON/OFF trigger is wired to the mobile radio CH VIP.**
Tactical DVR	Enable / Disable Check Box	If a DVR is to be used as a tactical repeater (without any mobile radio interfaced to it) this field must be set to Enable.	A Tactical DVR model requires a different Power cable that allows the DVR to be powered up by itself i.e. does not require a powered up MSU connected to it.
Low Battery Alarm	OFF – 13 Volts	When the DC supply voltage drops 0.5V above the programmed threshold, a **'BATTERY LOW'** warning will be displayed and the DVR will send warning tones to the portables over the air. If the voltage drops below the programmed level, the DVR is disabled and **'BATTERY LOW'** alternates with **'VR ERROR'** on the MSU CH display and the VR Transmitter is inhibited. When the battery voltage reaches 0.8 V above the programmed level the alarm condition is reset and the DVR resumes normal operation.	Typical setting is 10V.

Field Name	Range	Description	Notes
Engine Start Alarm	OFF – 9 Volts	In most installations the DVR is programmed to be in the OFF mode upon power up. If not, the **'Engine Start Alarm'** field may be enabled to prevent the DVR from transmitting when the voltage drops below the programmed threshold during engine start up.	This option may be useful only in installations where the DVR is programmed to power up in System or Local mode. Since the recommended DVR Power up mode is OFF, this option is not needed in most installations. Default setting is OFF.
MSU RF Bypass Switch	Enable / Disable check box	This field must be enabled on all in-band DVR models equipped with an RF Switch. Relay 1 must be selected in the 'Relay Use' field due to the Auxiliary Cable wiring.	Applies to In-Band DVRS Models Only. This option enables the Switch connecting the in-band filtering at the output of the MSU.
Band Lock	Enable / Disable	In some in-band application, the Band Lock feature may need to be disabled even though there is no In-Band filter provided with the DVRS. The typical application for Disabling the Band Lock is a Fixed DVRS installation where all the required isolation (min 70dB) is provided by antenna separation and no in-band filter is required.	If the '**MSU RF Bypass Switch'** option is enabled, this field is ignored. If the '**MSU RF Bypass Switch'** option is disabled, this field determines the MSU behavior if the MSU and DVR operate in the same frequency band.
External Master Light	Enable / Disable check box	This field needs to be enabled on DVR models using an external light which is lit when a DVR is a Primary or Permanent Primary. Relay 2 must be selected in the 'Relay Use' field due to the Auxiliary Cable wiring.	This option requires external switching logic and hardware (provided by installer).
Relay Use	'Not Used' 'MSU RF Bypass SW' 'Duplexer Bypass SW' 'Master Light' 'LOC Mode Light' 'SYS Mode Light' 'DVR ON light' 'External Alarm'	Relay 1 must be assigned to the RF Switch OR the Duplexer Bypass Switch if the corresponding option is installed. Relay 2 must be assigned to the Master Light if this option is installed. The MSU RF Switch option is included with all side-by-side and Transportable in-band models.	All Lights, Alarm relays and associated external logic are to be provided by installer.
AFC Cumulative	Enable Disable	Enables or Disables the Cumulative Automated Frequency Control (AFC) tuning.	Default setting is Enable. Set to Disable during calibration.
AFC Fast	Enable Disable	Enables or Disables the Fast AFC tuning.	Default setting is Enable. Set to Disable during calibration.

MSU Data

This screen provides MSU data for information purposes only.

PSU IDs Allowed

This menu screen is used to specify PSU IDs (or range of IDs) that are allowed to be affiliated on the system via DVRS. If analog portables are used and MDC ID pass through is required, then the PSU MDC ID must be enabled on the System and included in the PSU ID Data list of the DVR. If the range is set to be from '0' to '- -', then any PSU ID is allowed to talk through the DVRS. This screen is Password protected. To view the range of IDs the User needs to enter a password. To change the PSU ID list the User needs to log in as Admin (requires password).

DVR Remote Activation IDs

This screen allows the user to enter the console or system radio IDs of units that can page the MSU and toggle the DVRS mode. The default list is empty i.e. when the MSU is paged, the DVRS mode is not changed. If the MSU is programmed to have the remote activation enabled, then any Call Alert Page to the MSU ID from a system unit whose unit ID is programmed in the DVRS Remote activation ID table, will trigger DVRS mode change. In addition, a Group Page to a TG the MSU belongs to will toggle the DVRS mode as described above.

Talkgroup Translation Table

When the local PSU transmits on a TG that is in the DVR Translation table, the call will be transmitted on the TG currently selected on the MSU control head. The local PSUs must be programmed with Normal squelch or NAC=F7E in order to be able to receive outbound (system) or MSU Mic PTT calls when TG Translation is enabled. The **TG Translation** Table allows the user to program the Local PSU TG IDs that are enabled for TG Translation. The default list is empty, i.e. TG translation is disabled.

IMPORTANT!
Encryption Key Translation is not supported by the DVRS.

IMPORTANT!
The DVRS Translation table (and corresponding PSU programming) must not contain TG IDs that are used by the trunked FNE side.

Analog Setup

Field Name	Range	Description	Notes
System Mode Tones – Trailing	Enable / Disable Check box.	Enables or Disables the Trailing Tones sent by the DVR to the Local PSUs to indicate state of the transmission. The tones are sent at the end of LPSU transmission.	Affects Analog DVR Mode when used with Trunked MSU mode only. The tones are heard by all LPSU users that are on the selected DVR channel since they are sent over the air (not generated in the LPSU).
System Mode Tones – Lead	Enable / Disable Check box.	Enables or Disables the Lead Go Ahead Tones sent by the DVR to the Local PSUs to indicate successful / unsuccessful system channel access. The tones are sent at the beginning of LPSU transmission. The LPSU user needs to do 'double PTT' in order to be able to hear the Lead tones.	Affects Analog DVR Mode when used with Trunked MSU mode only. The tones are heard by all LPSU users that are on the selected DVR channel since they are sent over the air (not generated in the LPSU).
Local Mode Tones – Trailing	Enable / Disable Check box.	Enables or Disables the Trailing Tones sent by the DVR to the Local PSUs to indicate successful / unsuccessful DVR transmission. The tones are sent at the end of LPSU transmission.	The tones are heard by all LPSU users that are on the selected DVR channel since they are sent over the air (not generated in the LPSU).
Local Mode Tones – Lead	Enable / Disable Check box.	Enables or Disables the Lead Go Ahead Tones sent by the DVR to the Local PSUs to indicate successful / unsuccessful DVR transmission. The tones are sent at the beginning of LPSU transmission. The LPSU user needs to do 'double PTT' in order to be able to hear the Lead tones.	Affects Analog DVR Mode when used with Trunked MSU mode only. The tones are heard by all LPSU users that are on the selected DVR channel since they are sent over the air (not generated in the LPSU).
Portable Trunk Simulated Access	Enable / Disable Check box.	Enabled only when the PSU user is expected to do 'Double PTT' and Leading Tones are enabled.	
Busy Lockout MBX2 Compatibility	Enable / Disable Check box.	When Enabled, the DVR changes its voting algorithm so it is compatible with Mobexcom II VRs.	
Busy Lockout ID	0 - 127	If MBX Compatibility is Enabled, each DVR/VR needs to be programmed with a different ID. Larger fleets may have duplicate IDs programmed, preferably in different operation areas.	
Busy Lockout Master Bit Clr Time	0 – 180 minutes	If enabled (set to >0), the last DVR that was voted a Primary will have a priority in the next voting for the duration of the timer. The timer is reset every time a DVR is voted a Primary.	Default setting is 0 i.e. Disabled and all DVRS units have the same chance of becoming a Primary during every voting. Applicable only when MBX2 compatibility is enabled.
DTMF Remote Control Code	Up to 5 digits.	Upon receiving a matching DTMF sequence from a PSU, the DVR switches from OFF or Local to System Mode. The DVR and PSU must be programmed with the same DTMF sequence.	The PSU must be programmed with * as the last DTMF sign, for example 1234*.

Field Name	Range	Description	Notes
MDC Decode Delay Time	0-1000 ms	Set to 200 ms more than MDC 'System Pretime' programmed in PSU. If set to 390 ms or less, the DVR will wait for MDC signaling to be decoded before proceeding. If MDC is decoded DVR will proceed accordingly (initiate call, emergency handling, etc). If set to 400 ms or more, the DVR ignores PSU emergency retries for the duration of the timer to allow proper processing of a decoded MDC1200 emergency to the system and sending of emergency ACK to the PSU.	If the PSU MDC 'System Pretime' is set to 50ms, this field should be programmed as 250ms. If the PSU MDC 'System Pretime' is set to 700-800ms, this field should be programmed as 1000ms.
MSU Mode Steering Hang Time	0-60 seconds	When programmed to 0, the MSU stays on the steered mode after the PSU inbound call is over. If programmed to >0, the DVR forces the MSU to return to the original MSU mode when the PSU inbound call ends and the programmed timer expires.	Applicable when Steering is Enabled.
Microphone Signaling	None Leading Trailing Both	Specifies the type of MDC or TPS signaling sent by the DVR to the Local PSUs upon MSU Microphone PTT.	TPS signaling is applicable to TPS DVR Channels only.
Encrypted Call Support Inbound Calls Enabled	Enable/Disable Check Box	When enabled the DVR is capable of handling P25 Encrypted calls while on analog DVR channel.	Related to 'Outbound Call Audio' field: Enable when Outbound Call Audio set to Digital, Disable otherwise.
Outbound Call Audio	Digital Clear Warning Tones	Specifies the DVR repeat type when P25 Encrypted Outbound Calls are received by the MSU and an Analog DVR channel is selected.	Applicable to Analog Mode only. Related to 'Inbound Calls Enabled' field**.** **Important: Current implementation only supports 'Clear' selection if MSU is operating on Conventional Digital capable mode.**
Simplex PPI Interval	Disabled 500-10000ms	When enabled (Simplex Analog DVR channels only), the DVR will periodically interrupt transmissions during System outbound calls and check for PSU activity. If PSU activity is detected, the DVR will drop the outbound call repeat and give higher priority to the PSU Inbound call.	Applicable to Simplex Analog DVR channels only.

Field Name	Range	Description	Notes
Fallback in Analog Simplex Mode Enabled	Enable / Disable check box.	If enabled, a non-Primary DVR that detects a valid Inbound or Outbound Call will monitor for Primary DVR repeating the call and if such is not detected, the non-Primary DVR will repeat the call. The non-primary DVR only temporarily repeats the call and does not become a Primary when Primary repeat is not detected. The first few seconds of the Inbound or Outbound Call are always lost while the non-Primary DVR is checking for Primary repeat and deciding if fallback is needed. MSU MIC PTT will key up both the DVR and the MSU.	Applicable to Simplex Analog DVR Mode only.
PSU Analog Audio Queuing	500 – 1300ms	Defines the analog audio buffer, which prevents the loss of audio at the beginning of transmission while the MSU is acquiring channel grant. Longer time value may cause the PSU user to hear the tail end of his own transmission.	Default setting is 1000ms. Applicable to trunking systems where system access channel grant may take 1000 – 1500ms.
MDC PTT ID Offset	0 - 16777215	For future use	
PSU Priority Outbound Takeover By Voice Allowed	Enable / Disable check box.	Enables / Disables the PSU Voice takeover when the MSU is receiving an outbound call.	
PSU Priority Outbound Takeover By Signaling Allowed	Enable / Disable check box.	Enables / Disables the PSU Signaling takeover when the MSU is receiving an outbound call.	
PSU Priority Local to System Call Upgrade Enabled	Enable / Disable check box.	Enables / Disables the PSU call to be upgraded from Local to System when the MSU is no longer receiving an outbound call and is allowed to transmit to the FNE.	

DVR Common Setup

Field Name	Range	Description	Notes
Local Mode Allowed	Enable / Disable Check box.	Enables / Disables Local DVR Mode selection by the User.	The DVR can still revert temporarily to Local mode (when the System is not available) even if Local mode is Disabled.
Rptr Independent Channel Change	Enable / Disable Check box.	When Enabled the DVR channel can be selected independently from the selected MSU channel. When Disabled, the DVR channel is strapped to the selected MSU channel.	
Power Up Mode	Fixed Last Programmed	Specifies the DVR Mode upon Power Up. When 'Programmed' is selected, the DVR Mode is as programmed for the selected DVR channel or MSU Mode.	Default setting is Fixed. If AVRA is Enabled then the Power Up mode is driven by the AVRA input.
Fixed Mode	System Local OFF	Specifies the DVR Mode when Fixed Power up option is selected. Typical recommended setting is OFF.	Default setting for vehicular mount models is OFF
Channel	Disable – max # of programmed DVR channels	Specifies the Default DVR Power up Channel. If set to Disable, the DVR reverts to the last used channel upon Power up.	
No Activity Timer - Repeater	Disable – 120 min	If the DVR is not active (does not receive any local PSU calls) for the programmed period of time, it will automatically switch from System or Local to OFF Mode. The DVR sends warning tones to alert the Local PSU users every minute during the last 5 minutes prior to switching OFF.	Outbound calls, received by the MSU and repeated by the DVR will not reset the timer.
Display PTT ID **TG ID** **Hang Time**	Enable / Disable check box. 0-5 sec	Enables / Disables the display of Portable PTT ID and TG ID on the Control Head. Outbound calls TG ID is displayed (when enabled) during proxied calls as well. Determines the hang time during which the ID remains displayed after the call has ended.	
Repeater Active Tones	Enable / Disable check box	Enables / Disables the sending of tones when the DVR is switched to System (and optionally Local) Mode. The repeater active tones are transmitted over the air to all Local PSUs tuned to the same DVR conventional channel.	Tones are sent when switching from OFF to LOC or OFF to SYS occurs. Tones are not sent when switching SYS to LOC or LOC to SYS.

Field Name	Range	Description	Notes
Local Mode Active Tones	Enable / Disable check box	Enables / Disables the sending of tones when the DVR is switched on in Local Mode. The repeater active tones are transmitted over the air to all Local PSUs tuned to the same DVR conventional channel. Requires enabling of the **'Repeater Active Tones'** Field.	Tones are sent when switching from OFF to LOC or OFF to SYS occurs. Tones are not sent when switching SYS to LOC or LOC to SYS.
DVR Active Warning Tone Interval	0-255 sec	When the DVR is in either Local or System Mode, it can be programmed to sound "DVR Active" Tones in the MSU Speaker. This field specifies the repeat interval between those tones.	
MSU Mic call Repeat in LOC Mode	Enable / Disable check box	When the DVRS is in the LOCAL mode, this setting determines if MSU Mic calls are repeated by the DVRS to the Local PSUs (when Enabled) or not (when Disabled). This option is related to 'MSU System PTT in Local Mode' option in the MSU CPS which enables MSU Mic call repeat to system while DVRS is in LOCAL mode. Typically in LOCAL mode Mic calls are repeated only to Local PSUs by disabling 'MSU System PTT in Local Mode' and enabling 'MSU Mic Call Local Repeat in LOC Mode' option. Warning: if both options are disabled, functionality of the MSU microphone in LOCAL mode will be disabled	In single DVRS user applications this option could be used to disable local repeat and prevent audio feedback from MSU Mic and LPSU when the user is inside the vehicle. If 'MSU System PTT in Local Mode' option in MSU is enabled, MIC audio is transmitted to system. See **Table 3 Summary of Local Mode Microphone Audio Handling - Programmable Options**
MSU Mic call Repeat in SYS Mode	Enable / Disable check box.	When the DVRS is in the SYSTEM mode, this setting determines if MSU Mic calls are repeated by the DVRS to the Local PSUs. When disabled (unchecked) the DVRS does not transmit Mic audio to the LPSUs when the MSU Mic is PTT-ed and the DVRS is in the SYSTEM mode. When enabled (checked), MSU Mic call audio is transmitted by both the MSU and the DVR when the DVR is in SYSTEM Mode. This is default option for DVR.	In single DVR user applications this option could be used to disable local repeat and prevent audio feedback from MSU Mic and LPSU when the user is inside the vehicle.

Field Name	Range	Description	Notes
DVR Activation via MSU Mode Change	Enable / Disable check box.	Enables / Disables the DVR activation by changing the selected MSU Mode. If disabled and the DVR is in OFF mode, changing the MSU selection to a new mode programmed for SYSTEM or LOCAL will not cause any change to the DVR mode (DVR stays OFF). If enabled and the MSU mode is changed to a new one programmed for SYSTEM or LOCAL then the DVR will switch from OFF to SYSTEM or LOCAL respectively.	
System Channel Acquisition Time	600 – 6000 ms	Determines the DVR wait time for the system grant before the DVR decides what tones (ACK or NACK) must be sent to the Local PSUs and starts local repeat.	This timer also determines the maximum number of retries that will be made by the DVRS in order to acquire a system channel. These retries are sent every second so if the intent is to allow 2 retries, the timer needs to be set to 1800 – 2000ms in order to allow sufficient system response time.
This VR ID	number	Specifies the ID of the DVR, which is used for remote DVR mode and TG change. If not specified, the DVR will assume the ID of the currently interfaced MSU.	Refer to the **Remote DVR Control / TG Steering** Section of this Document.

MSU CPS MSU System PTT in Local Mode	DVRS Tweaker MSU Mic Call Local Repeat in LOC Mode	Tx Mic Audio to FNE/system	Tx Mic Audio To Local PSUs	Comment
☐	☐	No	No	**Warning:** MIC functionality disabled, audio not transmitted
☐	☑	No	Yes	Typical setting for DVR
☑	☐	Yes	No	
☑	☑	Yes	Yes	

Table 3 Summary of Local Mode Microphone Audio Handling - Programmable Options

Emergency Setup Menu

Field Name	Range	Description	Notes
Analog Emergency Signaling Type	Disable MDC1200 ANI-5 Tones	Determines the type of emergency signaling used by the Local Analog PSUs. When ANI-5 Tones is selected, the PSU must be programmed to transmit 4 Tones followed by B - for example 1234B. The Emergency ACK sent by the DVR to the PSUs will be the same tones followed by A i.e. 1234A.	Affects Analog Mode only.
Display PSU Emergency ID	Enable / Disable Check box.	Enables / Disables the Local PSU ID display during the processing of an Emergency by the DVR.	In Digital Mode – the P25 Unit ID is displayed on the Control Head, Local PSUs, System Radios and Dispatcher Console. In Analog Mode – the MDC1200 or ANI ID is displayed on the Control Head.
Send Emergency Ack. Tones	Enable / Disable Check box.	Enables / Disables the Emergency ACK Tones sent by the DVR to Analog PSUs.	Affects Analog Mode only. All Tones sent by the DVR in Analog Mode are heard by all PSUs tuned to the same DVR Channel, which PSUs are within the DVR radio coverage area.
Portable Ack Required	Enable / Disable Check box.	Enables / Disables the Emergency ACK signaling sent by the DVR to the PSU when the DVR receives a PSU Emergency Alarm.	Default setting is Enabled.
Attempts Timeout	30-255 s	After decoding an Emergency request from a PSU, a Secondary DVR waits for the duration of this timer and if no other emergency request is received from the PSU, the counter will be cleared. If another emergency request is received, the DVR will increment the counter accordingly – refer to the **Attempts Counter** Setting.	
Attempts Counter	0-10	Determines the number of PSU Emergency attempts a Secondary DVR will need to detect before it switches to Primary System Mode and processes the Emergency to the System. This counter is reset when the DVR sends an ACK to the PSU or when the **Attempts Timeout** timer expires. When set to 0 – the Secondary DVR will not monitor if the PSU Emergency is being serviced by a Primary DVR or not.	
ANI 5 Tone Type	EEA CCIR EIA	Determines the ANI 5-Tone Type. Must match the Analog PSU programming.	Affects Analog Mode only.

Field Name	Range	Description	Notes
Emergency Cancel **Analog Signaling Type**	 Disable ANI 5-Tones DTMF	If enabled, the DVR will clear the emergency upon detection of the programmed Emergency Cancel Code.	Affects Analog Mode only.
Emergency Cancel Timeout	OFF-600sec	If programmed, the DVR will automatically clear the emergency upon expiration of the programmed timer.	Affects all modes.
Emergency Cancel ANI Code	number	This field specifies the Emergency Cancel ANI /DTMF Code sequence. Must match the Analog PSU programming.	Affects Analog Mode only. Applicable only if the Emergency Cancel Signaling Type Field is Enabled. The PSU must be programmed with * as the last DTMF sign, for example 456*.
FG Emergency Destination	Local System Both	Determines the routing of Emergency message received by the DVR from a Local PSU on a FG enabled DVR channel.	Applicable to DVR channels which have FG signaling enabled.
Disable DVR Emergency Call State	Yes / No	When enabled, if emergency alarm or call was declared by an analog PSU, the DVR enters Emergency Call State and remains in this state until all the MDC PSU emergencies are cancelled by the PSU or DVR. While in Emergency Call State DVRS would forward all calls received from the analog PSUs without leading PTT ID as emergency calls. Calls received from analog PSUs with the leading PTT ID would be handled accordingly. The DVR Emergency Call State is cancelled by pressing the DVRS button, by preprogrammed emergency cancel timer or remotely via Emergency Cancel ANI code.	Applicable to Analog DVR mode and analog PSUs only.
Digital Emergency DVR Emergency Echo ACK Enabled	Enable / Disable check box	Must be Disabled when using Generic P25 PSUs since they will treat signaling level Ack as application level Ack. Must be Enabled when using DVRS Enabled PSUs and 'Console Ack'.	Requires 'Digital Emergency Portable Ack Required' to be Enabled.
Digital Emergency Portable Ack Required	Enable / Disable check box	Enables / Disables the sending of low level ACK by the DVRS to the PSU upon receipt of an Emergency Alarm.	The Emergency ACK type is sent by the DVR depending on its programming – VR ACK / Site (FNE) ACK or Console ACK. Default setting is Enabled.

Field Name	Range	Description	Notes
TG1 Translation Disabled	Enable / Disable check box	Default setting is unchecked (TG1 translation is enabled). In this case when a PSU emergency is received (on default TG1), the DVR translates the TG ID to match the currently selected MSU TG ID. This way the emergency is announced on the selected MSU TG, not on TG 1, which may not even exist in the specific trunking system.	Applicable to Fireground Analog, Mixed and TPS type DVR channels.
Switch DVR from LOC to SYS if MSU in Emergency	Enable / Disable check box	When the DVR is in the LOC mode and the user presses the Emergency button on the MSU CH the DVR will switch from LOC to SYS mode when this option is enabled (box is checked). If the option is not enabled, the DVR stays in LOC mode after Emergency is declared on the MSU.	

Tone Setup Menu

The tones setup screen allows programming of custom tones / tone sequences, which are sent by the DVR to the Analog PSUs during Analog Mode of operation only.
If no custom tones are programmed, the DVR will send the default sets of tones.

NOTE:
The tones sent by the DVR in analog mode are heard by all analog PSUs, which are tuned to the same DVR channel and are within the DVR RF coverage area.

Morse Code Menu

The Morse code option needs to be programmed only when a DVRS is to be used as a fixed repeater and the FCC rules require transmission of Repeater ID via Morse Code.

Digital System Setup Menu

Field Name	Range	Description	Notes
Call Setup – Pass Queue Response to PSU	Enable / Disable Check Box	If a Local PSU (affiliated through the DVR) PTTs and the Call is Queued by the Trunking System, the DVR does one of the following: * if the **Pass Queue Response Box is checked** → the DVR sends a Queue message to the PSU and forces the PSU to wait until System grant is received or * if the **Pass Queue Response Box is unchecked** → the DVR enables the PSU Call to be repeated locally (to the other Local PSUs while it is not repeated on the System side).	
Call Setup – Local To System Call Upgrade Enabled	Enable / Disable Check Box	When a Call from a Local PSU (affiliated through the DVR) has been put in the Queue by the System or blocked by MSU conflicting service, and System grant is received during the DVR's Local repeat of the PSU Call, one of the following will occur: * if the **System Busy Channel Grant** is checked → the DVR promotes the Local Call to System so that the remainder of the PSU Call is repeated to the System Users or * if the **System Busy Channel Grant** is unchecked → the DVR repeats the Call Locally only until the Call is completed.	This setting is applicable if the **Pass Queue Response to PSU** is Disabled i.e. Unchecked or the **System Channel Acquisition time** (see System Setup 2) has been exceeded.
Call Setup – Pass Deny Response to PSU	Enable / Disable Check Box	If a Local PSU (affiliated through the DVR) PTTs and the System sends back a Deny response, the DVR does one of the following: * if the **Pass Deny Response Box is checked** → the DVR sends a Deny message to the PSU and the call is cancelled; * if the **Pass Deny Response Box is unchecked** → the DVR enables the PSU call to be repeated locally (to the other Local PSUs) but not to the System.	
Individual Call Setup Private Call Setup Timeout	5-60 sec	Determines the time a Local PSU waits after initiating a Private Call to another Local PSU to receive a reply from the destination Local PSU. If the timer expires before the destination PSU replies, the DVR cancels the Private Call. Must be set to match the settings of the PSU.	Affects Private Calls between Local PSUs only. The DVRS handling of Private Calls between Local and System PSUs is based on the Timeout settings of the P25 System.

Field Name	Range	Description	Notes
Individual Call Setup Private Call Hang Timeout	10-60 sec	If no PSU activity is detected for the duration of this timer, the DVR cancels the Private Call and is ready for servicing other calls.	Typical recommended setting is 30 seconds.
Individual Call Setup Telephone Interconnect CCT	OFF – 60 minutes	If a telephone call between a local PSU and the trunking system is processed by a given DVRS and the call exceeds the programmed timer, the call will be automatically disconnected. This timer applies to phone calls only.	
Individual Call Setup Telephone Interconnect Hang Timeout	10-60 sec	If no call activity is detected for the duration of this timer, the DVR cancels the phone call.	Typical recommended setting is 30 seconds.
P25 Frame Sync Detection Timer	30-255ms	Upon Carrier Activated Squelch (CAS) activation, if the DVR digital decoder does not detect P25 Frame sync before this timer expires, the DVR analog decoders will be switched on (i.e. PL/DPL, DTMF, MDC1200…).	Applicable to Mixed Mode DVR Channels only. Default recommended value is set to 100ms.
VR Ch Mixed Mode Hold Timer	0-255 sec	This timer determines the DVR Mode Hang Time. If the DVR receives a call from an Analog PSU, the DVR will stay in Analog mode until this timer expires. Any System reply which is received before the timer's expiration will be transmitted in Analog Mode. The timer is started when the originating Analog PSU keys OFF. Upon expiration of the timer, the DVR switches to digital repeat mode.	Applicable to Mixed Mode DVR Channels only. When a Mixed Mode DVR channel is selected, the default DVR mode is P25 Digital.

Field Name	Range	Description	Notes
PSU Proxy Disabled	Check box	If this box is checked, the TG Proxing feature is disabled and the Local PSU and MSU must be on the same TG in order to establish communications. If the Local PSU and the MSU are on different TGs, the Local PSU will not be able to affiliate and as a result it will not be able to make calls until the TG selection is matched.	Applicable to Digital & Mixed Mode only. Allows Local PSU users to switch to different TGs and their calls to be proxied by the DVRS regardless of the selected MSU TG (as long as it is 'DVR Enabled').
PSU Priority Inbound Takeover Allowed	Check box	When enabled, the DVR gives higher priority to a LPSU call initiated during an ongoing LPSU call.	
PSU Priority Outbound Takeover by Voice Allowed	Enable / Disable Check box	Enables / Disables the PSU Voice takeover when the MSU is receiving and DVR repeating an outbound call.	
PSU Priority Outbound Takeover by Signaling Allowed	Enable / Disable Check box	Enables / Disables the PSU Signaling takeover when the MSU is receiving and DVR repeating an outbound call.	
Network Status Reporting Interval	0-255 sec	Determines the intervals for sending Trunking Network Status messages (Failsoft, Out of Range or Site Trunking) as well as 'Local Mode' Indication to the Local PSUs.	The Local PSU will wait two times the programmed interval before it declares being Out Of Range.
PSU Affiliation Timeout	0-72 hrs	Determines the time a PSU ID will be kept in the DVRS affiliation table without detecting any activity from the PSU. After the timer has expired, the DVRS deregisters the PSU and sends a deregistration request to the system.	Recommended setting should match that of the 'Affiliation Inactivity Timeout' of the System (default is 12 hrs).
PSU Digital Audio Queuing	700 – 1800ms	Defines the digital audio buffer, which prevents the loss of audio at the beginning of transmission while the MSU is acquiring channel grant. Applicable to trunking systems where system access channel grant may take 1000 – 1500ms.	Default setting is 1000ms. Reducing the buffering time provides lower throughput delay, however may result in truncated audio when accessing the system due to poor coverage takes longer.
P25 Preamble Length	0 – 400ms	This setting must be matched with the APX PSU programming to ensure adequate PSU unmuting.	Default setting is 40ms.
Adaptive Power Control Enabled	Check box	If this box is checked the DVRS sends P25 messages to the Local PSUs to adjust their transmit power depending on the received signal strength. Enabling this feature is NOT recommended in applications where more than one PSU are used with a single simplex DVRS since it will affect the PSU-to-PSU communications range. If this box is unchecked the Portable power levels will be set to the codeplug default.	Extends the battery life of the XTS/APX Generic and 'DVRS Enabled' Portables when they are operated in digital mode.

Primary / Secondary Setup

Field Name	Range	Description	Notes
Disable Primary / Secondary Processing	Enable / Disable Check Box	Enables / Disables the Primary / Secondary Processing globally.	Refer to the **Primary / Secondary Operation** Paragraph of this Document.
Disable Primary / Secondary Processing On Analog VR Channels	Enable / Disable Check Box	Enables / Disables the Primary / Secondary processing on analog channels only.	**If M/S is disabled on analog channels, the BL must be enabled or else there will be no simulcast prevention processing.**
Enable BL for Outbound Voice Comm. and Heart Beat	Enable / Disable Check Box	Enables / Disables the dynamic phase of the Busy Lockout Algorithm for Outbound Voice calls and sending of Heart Beats.	Refer to the **Primary / Secondary Operation** Paragraph of this Document. Applicable to both Analog and Digital DVR Mode.
Enable BL for Inbound Voice Comm.	Enable / Disable Check Box	Enables / Disables the dynamic phase of the Busy Lockout Algorithm for Inbound Voice calls.	Refer to the **Primary / Secondary Operation** Paragraph of this Document. Applicable to both Analog and Digital DVR Mode.
Permanent Primary Status Enabled	Enable / Disable Check Box	If this box is checked the DVR will always be forced into Permanent Primary State.	The Default setting is Disabled. **Programming more than one DVRS as a Permanent Primary in a given system may result in interference and loss of communications.**
Permanent Primary Control Disabled	Enable / Disable Check Box	If this box is checked the DVR status can not be changed to Permanent Primary by pressing the VRS button on the Control Head of the MSU.	The Default setting is not checked i.e. User Control is allowed.
Heart Beat Interval	3-60 sec	Determines the time intervals at which a Primary or Permanent Primary DVR transmits Heart Beat messages to all other DVRs in the area.	Refer to the **Primary / Secondary Operation** Paragraph of this Document. 'Heart Beat' messages are part of the Static BL Algorithm Phase and are transmitted on the DVR Rx frequency.

MSU Interface Setup

Field Name	Range	Description	Notes
DVR Language Selection	'English' 'French'	Specifies the DVR Language Selection, which should match the MSU language selection.	If the MSU is using a different language selection besides English or French, the DVR should be set up for English.
Number of Impolite Retries	0 - 15	Specifies the number of impolite retries sent by the DVRS to the System upon receiving an Emergency Alarm from the PSU.	Applicable to Conventional MSU Mode. It is recommended that a longer sequence is programmed in the DVR compared to what is programmed in the PSU.
Number of Polite Retries	0 - 15	Specifies the number of polite retries sent by the DVRS to the System upon receiving an Emergency Alarm from the PSU.	Applicable to Conventional MSU Mode. It is recommended that a longer sequence is programmed in the DVR compared to what is programmed in the PSU.
Number of Emergency Retries	0 - 15	Specifies the number of Emergency retries sent by the DVRS to the System upon receiving an Emergency Alarm from the PSU.	Applicable to Trunked MSU Mode
Fast Retries Timer	500 –1500 ms	Amount of time the DVR will wait for a response from trunking system to a previous request.	Set to 750ms as default
Slow Retries Timer	1000- 5000 ms	Amount of time the DVR will wait to allow conventional system to respond to a previous request.	Default setting is 3000 ms.
Response Pending Timer	500-2000 ms	Amount of time the DVR will wait for an <Application Level Response> after receiving a <Signaling Level Acknowledgement>. DVR will stop retries but hold off from sending any other Proxy Requests until it receives an <Application Level Response> from the FNE or the DVR response pending period expires.	Set to 750ms as default
Menu Timeout	0 – 120 s	Specifies the DVR Selection Menu Timeout	0 = No Timeout
Short DVRS Button Press	'DVR Menu' 'DVR Activation / Deactivation'	Specifies the Short DVRS Button press selection assignment.	
Long DVRS Button Press	'None' 'DVR Activation / Deactivation' 'Permanent Primary Control'	Specifies the Long DVRS Button press selection assignment.	

DVR System Topologies

The following table provides an overview of all possible DVR system configurations and whether or not each is supported. The rest of the document provides details on the supported system topologies.

PSU Type	DVR Ch	MSU / System Type				
		Conv. Analog	Conv. P25	Type II Trunked	P25 FDMA Trunked	P25 TDMA Trunked
Analog	**Analog**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Digital	No	No	No	No	No
	Mixed	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Forced Analog	**Yes**	No	**Yes**	No	**Yes**
P25 Generic	**Analog**	No	No	No	No	No
	Digital	No	**Yes**	No	**Yes**	No
	Mixed	No	**Yes**	No	**Yes**	No
P25 DVRS Enabled	**Analog**	No	No	No	No	No
	Digital	No	**Yes**	No	**Yes**	No
	Mixed	No	**Yes**	No	**Yes**	No
	Forced Analog	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Table 4 DVR System Topologies

Global DVRS Features

This section describes Global DVRS features, which are common for all DVR channel types.

Automated VR Activation (AVRA)

The MSU has Vehicular Interface Port (VIP) inputs that can be wired to a switch (refer to the Motorola MSU installation documentation), which can be used for activation / deactivation of the DVR. The switch that asserts the VIP Input could be the opening of the car door, the removal of a PSU from the charger, a manual switch, parking brake switch or a combination of the above. Alternatively, the AVRA trigger can be wired to the designated pin on the DVR auxiliary cable as described in Part I of this manual.

The handling of the VIP inputs is determined by the 'AVRA Function' field programming in the DVR as follows:

- **Activation / Deactivation**: The DVRS activates when the VIP input is asserted and deactivates when the VIP input is de-asserted.
- **Activation Only**: The DVRS activates when the VIP input is asserted and does NOT deactivate when the VIP input is de-asserted.
- **Toggle**: The state of the DVR is toggled every time the VIP Input is asserted. No action is taken when the VIP Input is de-asserted. This setting is intended to be used when a car door switch is used as the AVRA trigger (opening the door activates the DVR but closing it does not deactivated it).

The following table provides summary of the AVRA functionality as a function of the DVR programming:

AVRA Configuration	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 1st	OFF	SYSTEM
Toggle	False	Asserted 1st	OFF	LOCAL
Toggle	True/False	Asserted 2nd	LOCAL	OFF
Toggle	True	Asserted 2nd	SYSTEM	OFF
Toggle	True/False	De-asserted	ANY	NO CHANGE

Table 5 AVRA Functionality

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 an 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.

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 HUB on / off transitions OR via Menu Item / Button on the MSU control head or keypad Mic.

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

Proxied Private Calls are never heard on the MSU speaker regardless of the Hang Up Box (HUB) status.

NOTE:
Inbound Private calls to the MSU are not supported. Outbound Private Calls to the MSU are heard on the MSU Speaker.

Primary / Secondary - Operation and Programming Overview

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

IMPORTANT!
The DVRS voting algorithm is designed to handle stationary, same scene deployment scenarios only. It cannot be applied to moving vehicles with active DVRS! Moving vehicles must have their DVRS switched to OFF or VR Disabled mode.

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 Secondary (i.e. on stand-by) 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 Secondary mode and execute Primary/Secondary checks periodically.
The 'Primary' DVR services any communication requests in the area and periodically 'communicates' its status to the other DVRs.
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 transmit 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 transmit power during DVRS-to-DVRS transmission is set by the **'R-Tx Pwr'** field in the **Repeater Channel Setup** Menu. Typically this field is selected to be 4-5dB lower than the **'Tx Pwr'** setting.
Before a Primary DVR sends out a 'Heart Beat', it checks for RF activity on its receive frequency to ensure the channel is free. If an RF signal is present and it exceeds the programmed **'Rx RSSI Th'**, the DVR will wait until the channel is free before it transmits its 'Heart Beat'. When a Secondary DVR stops receiving 'Heart Beats', the DVR will check for any activity on the transmit frequency to determine if the Primary DVR is busy transmitting. If there is a transmission detected on the transmit frequency and it exceeds

the programmed 'Tx RSSI Th', the DVR will continue operating as a Secondary and continue waiting for a 'Primary Heart Beat'. If no activity is detected above the **'Tx RSSI Th'** and 3 Heart Beats are missed, the Secondary DVR will start negotiating becoming a Primary.

IMPORTANT!
The DVR cannot transmit Heart Beats while it is busy repeating.

The 'Heart Beat' Interval (3-60 sec) is set by the **'Heart Beat Interval'** field in the **Primary/Secondary Setup**. The default programmed Heart Beat Interval value is 5 seconds. When the **'Enable BL For Voice Communication'** field (**Primary/Secondary Setup** Screen) is enabled (checked), the DVRS goes through an extra simulcast prevention check step. Prior to transmitting, a Primary DVR checks for any transmission (on the DVR Tx frequency) exceeding the programmed **'Busy LC Th'** (see **Repeater Channel Setup** Menu). If no such RF transmission is detected on the transmit frequency, the Primary DVR starts transmitting i.e. repeating. If transmit activity is detected, the DVR transmits momentarily then checks again if another DVR is still transmitting and either backs off (if the other DVR is still transmitting) or keys up if no transmission is present. Disabling the DVR Primary / Secondary Processing from the **Primary/Secondary Setup** Menu is intended for test purposes or if the DVR is installed in a fixed location. The '**Permanent Primary Status Enable'** field (in the **Primary/Secondary Setup** Menu) is disabled by default and should be used only at remote, fixed DVR installations or during testing. The **'Rx RSSI Th'** field in the Repeater Channel Setup screen determines the Primary / Secondary range. If a DVR is receiving Primary Heart Beat from another DVR at a level lower than the programmed threshold, the DVR will ignore the Primary Heart Beats and will negotiate becoming a Primary DVR as well. The **"Disable Primary / Secondary Processing"** box is to be checked only during bench testing. Primary / Secondary processing should always be enabled during normal DVR operation except during bench testing and in some fixed isolated installations (tunnels or in-building systems using common filtering / combiners).

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.

Remote Mode change of DVRS by FNE / Dispatcher

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:

- **Call Alert / Remote Activation Disabled** – the MSU does not respond to any Call Alert requests
- **Call Alert Enabled** – the MSU responds to Call Alerts addressed to its ID and does NOT initiate DVRS mode change
- **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.

MSU Scan

Supported MSU Scan Types

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

- Conventional Scan
- Mixed Conventional Voting Scan
- Legacy Voting Scan

When the DVR is activated (System or Local Mode), the MSU scan feature is NOT allowed if the MSU Scan type is configured in the selected MSU personality as one of the following:

- Multi-System Scan
- Priority Monitor Scan

DVRS Enabled / Disabled Rules while MSU Scan is enabled

The Selected DVR channel settings are used across all MSU scan channels except when the DVR operation is Disabled for the given MSU channel.
If the DVR selected channel is Digital and the MSU scans to an analog channel, the DVR will become temporarily disabled.
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 DVR 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 DVR to the PSU. Emergency Alarm / Call originating from a secondary channel are supported through the DVR.

Inbound Calls (received by DVR from PSU) with MSU Scan Enabled

MSU Talkback and Designated TX are not supported when a PSU makes a call through the DVR 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 DVR.
Talkback and Designated TX are supported only for MSU initiated calls.

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
- Priority Channel PTT
- PSU Reprogram request / Selector Lock
- 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 for specific feature support information.

Digital DVR Mode - Operation and Programming Overview

Digital DVRS Mode assumes the following:

- Selected DVR channel is programmed for digital or mixed mode.
- P25 PSU either programmed for digital DVR operation or Generic P25 and with Digital mode currently selected (referred to as a **Local PSU**).
- A DVRS Enabled, P25 MSU mode is selected on the MSU.

The DVR Channel programming requires that **Digital** or **Mixed** mode is programmed for the specific DVR channel and the Tx/Rx frequencies as well as the Tx/Rx NIDs of the PSUs and the DVR are matched.

NOTE:
Forced Analog Mode is a hybrid mode in which the communications between the DVRS and the 'DVRS Enabled' P25 PSU including all signaling are digital, while the voice communications are 'forced' to be analog when the MSU is on a non-P25 channel / TG. When a P25 channel / TG is selected on the MSU, both signaling and voice between the 'DVRS Enabled' P25 PSU and DVR are P25 Digital.

PSU Affiliation

When a local PSU User selects a DVR Enabled Mode, 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).

IMPORTANT!
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 Priority Level	MSU Request
LOW	Idle (incl. in Emergency Call, not receiving audio) Group Voice Receive (all group call types, including hangtime 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 6 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 7 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 8** Signaling Request Interaction with Signaling Proxy and **Table 9** Signaling Request Interaction with Voice Proxy 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 8 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 9 Signaling Request Interaction with Voice Proxy

Voice Request Interaction with Signaling and Voice Proxy

Voice request interactions with signaling proxy are described in **Table 10.** 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 11**.

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 10 Voice Request Interactions with Signaling Proxy

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

New Request	Existing Request	'Inbound Takeover Allowed'	'Outbound Takeover by Voice Allowed'	Action*
Low Priority Voice	Individual Voice Hangtime	Enabled or Disabled	Disabled	Discard New Request

Table 11 Voice Proxy Interaction with Voice Proxy

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

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' Mode, 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 programmable 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 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 can be programmed to send P25 messages to the Local PSUs to adjust their transmit power depending on the received signal strength from the DVRS 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.

NOTE:
Adaptive Power Control is supported on both 'Generic P25' XTS/APX PSUs as well as on "DVRS Enabled" PSUs.

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 encrypted voice 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 12 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 13 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 14 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 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 15**).

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	**SYSTEM** **PRIMARY** DVR CH 1 MSU TG 1	LOCAL OR SYSTEM PRIMARY DVR CH 1 MSU TG 1	**LOCAL OR SYSTEM** **SECONDARY** **DVR CH 1** **MSU TG 1**
Call Alert (Page) to: **DVRS A PSU on TG 1**	OFF OR LOCAL SECONDARY DVR CH 1 MSU TG 1	**SYSTEM** SECONDARY DVR CH 1 MSU TG 1	LOCAL OR SYSTEM PERM. PRIMARY DVR CH 1 MSU TG 1	**LOCAL OR SYSTEM** **PERM. PRIMARY** **DVR CH 1** **MSU TG 1**
Call Alert (Page) to: **DVRS A PSU on TG 2**	OFF OR LOCAL SECONDARY DVR CH 1 MSU TG 1	**SYSTEM** **PRIMARY** DVR CH 1 **MSU TG 2**	LOCAL OR SYSTEM PRIMARY DVR CH 1 MSU TG 1	**LOCAL OR SYSTEM** **SECONDARY** **DVR CH 1** **MSU TG 1**
Call Alert (Page) to: **DVRS A PSU on TG 2**	OFF OR LOCAL SECONDARY DVR CH 1 MSU TG 1	**SYSTEM** SECONDARY DVR CH 1 **MSU TG 2**	LOCAL OR SYSTEM PERM. PRIMARY DVR CH 1 MSU TG 1	**LOCAL OR SYSTEM** **PERM. PRIMARY** **DVR CH 1** **MSU TG 1**
Call Alert (Page) to: **DVRS A PSU on CONV1**	OFF OR LOCAL SECONDARY DVR CH 1 MSU TG 1	**SYSTEM** **PRIMARY** DVR CH 1 **MSU CONV1**	LOCAL OR SYSTEM PRIMARY DVR CH 1 MSU TG 1	**LOCAL OR SYSTEM** **SECONDARY** **DVR CH 1** **MSU TG 1**
Call Alert (Page) to: **DVRS A PSU on TG1**	**OFF OR LOCAL** **SECONDARY** **DVR CH 1** **MSU CONV1**	**SYSTEM** **PRIMARY** **DVR CH 1** **MSU TG 1**	**LOCAL OR SYSTEM** **PRIMARY** **DVR CH 1** **MSU TG 1**	**LOCAL OR SYSTEM** **SECONDARY** **DVR CH 1** **MSU TG 1**

Table 15 Typical Remote Steering Scenarios

The following table illustrates the programming requirements pertaining to all templates involved (DVR, PSUs):

DVR Programming – Repeater Channel Setup:		
CH #	**RX NID**	**TX NID**
1	F7E	10

DVR Programming – Mobile Radio Channel Setup:		
TG /CH Name	**Steer NID**	**VRch**
TG1	4	1
TG2	5	1
CONV1	6	1

PSU Programming Template - DVR CH 1:		
RX NID	**TX NID**	**TG / CH**
10	4	TG1
10	5	TG2
10	6	CONV1

Table 16 Programming Example - Remote Steering

NOTE:
F7E Enables the DVR / PSU to receive on any NID and TG ID.

The F7E setting ensures the DVR will receive when the PSU transmits different TX NIDs (4, 5, 6 in the above example). When a PSU user selects TG2 and sends a Call Alert / Page to the DVR (using the unique DVR ID number), the PSU will transmit with TX NID 5. The DVR will detect steer NID 5 and switch the MSU to TG2. The DVR will be repeating the call with TX NID 10, which is received by the PSU on any of the steerable TGs. All of the above settings refer to DVR CH1 i.e. the PSU remotely steers TGs on the same DVR channel. DVR channel steering is not recommended.

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 processing, the unit ID of the local PSU, which has initiated the Emergency Alarm, 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 and 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:
    a. If the revert TG is on the DVRS TG Translation list, then proxied PSU 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.
    b. 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 form 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 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.

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 GPS

GPS is supported on 'DVRS Enabled" PSUs when the MSU is operating on a P25 Trunked mode. PSU Location reporting (GPS) is supported on a single PSU via the DVRS. This feature relies on PSU IV&D functionality described above.

Automatic PSU Revert to Talk Around (TA)

The DVRS Enabled PSU 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.

Forced Analog DVR Mode - Operation and Programming Overview

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.

Analog DVR Mode - Operation and Programming Overview

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 default digital and temporary 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 due to the switching from digital to analog mode dynamics. 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.

PSU Affiliation

When the MSU is operating on a P25 Trunked system (FDMA or TDMA), local analog PSUs are affiliated when PTT ID (MDC1200) pass-through is enabled or when an Emergency Alarm (MDC1200) is sent by the Local PSU. The above assumes the PSU MDC ID is allowed on the P25 trunking system. The MDC Unit ID and Trunked unit ID ranges are not the same. Portable radio reprogramming may be required in order to have valid unit IDs that can be recognized by the P25 trunking system.

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 Tactical Public Safety (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 (refer to **Analog Setup** screen in Tweaker for DVRS programming instructions related to this feature).
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.

NOTE:
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 an 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 (FDMA)	Transmit Encrypted	P25 Encrypted
P25 Encrypted	Transmit Clear	Clear Analog
P25 Encrypted	Send Warning Tones	Warning Tones

IMPORTANT!
If the MSU is operating on a TDMA mode, the DVR cannot transmit Encrypted Audio to the PSUs.

Leading & Trailing Tones

The DVR can be programmed to send over-the-air Leading or Trailing tones to the local PSUs to indicate successful MSU key up / system access.
If Leading Tones are enabled, the local PSU operation involves the following:

1. User does a quick PTT of local PSU so that MSU can request channel grant
2. User releases the PTT for a moment and waits to hear the Leading tones.
3. If the Leading tones indicate successful system access (channel grant), the local PSU user PTTs again and talks.
4. 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 local PSU 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 local PSUs 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 or Forced Analog mode.
For Forced Analog mode operation, please refer to the **Forced Analog Mode** section of this document.
When the DVR is on an analog channel and the MSU is on a TDMA capable channel, the following features are supported via the DVRS:

- Emergency Alarm and Call (MDC1200)
- Group voice, Inbound and Outbound
- MDC PTT-ID
- Emergency ID
- Status Update (MDC1200)

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.

Mixed DVR Mode

When a DVR channel is programmed to operate in Mixed mode, the DVRS can handle calls from both P25 and analog local PSUs.

When Mixed Mode is selected, the DVR can be toggled between digital and analog Mode as described below. 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 etc.). The DVR enables the repeat of Analog signals to the Local Analog PSUs. 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.

The DVRS operation in Mixed Mode is determined by the settings of the **'P25 Frame Sync Detection Timer'** and **'VR Ch Mixed Mode Hold Timer'** as programmed in the **Digital System Setup** menu screen.

Using the Tweaker's RSSI Setup Application

The DVRS **RSSI Setup** screen is provided in order to assist the users with optimizing the voting algorithm parameters by creating a typical real life scenario for DVRS operation and running some automated DVRS tests as described below.

The RSSI setup screen is used to assist with the setup the following DVRS parameters on a per channel basis:

- **RSSI ON threshold**
- **Busy Lockout Threshold**
- **TX RSSI Threshold**
- **Rx RSSI Threshold**

Setting up the RSSI ON range

The **RSSI ON threshold** defines the DVRS incident range since this is the minimum signal level the DVR receiver needs to detect from the Local PSU in order to repeat it locally and to the System.
RSSI ON threshold is normally programmed to standard -114dBm. However, if the user wants to test the actual levels received from a portable radio located at the desired coverage area extreme then the 'RSSI ON Level Test' can be performed.
To execute the test, the following steps are to be followed:

1. PSU user is located at the edge of the desired coverage range and the PSU is switched to the correct channel (matching the channel selected on the DVR).
2. Tweaker is running on the Primary DVRS and Monitoring screen is open as shown above.
3. Select 'System' or 'Local' Mode in the 'Operating Mode' Field.
4. Switch 'Set Test Mode' to ON.
5. Press the 'RSSI ON Level Test' button.
6. The PSU User will hear 3 short and 1 long beeps and he/she must immediately press and hold the PTT for 10 seconds.
7. The DVRS measures the received signal level and updates the RSSI ON Threshold field. The check box against the parameter is checked to indicate test completion.
8. Enter desired Margin (min 6dB or higher recommended).
9. Repeat the test for all required channels.
10. Close the monitoring screen or proceed with the Voting algorithm tests as described below.
11. Review the 'RSSI ON Threshold' levels on the 'Repeater Channel setup' screen and save to the DVRS and in a dpd file as required.

Setting up the Voting Parameters (Primary / Secondary Range)

Those automated tests are used to calibrate the range between two Primary DVRS as follows:

DVRS 1 – DVR with Tweaker running and RSSI Setup screen open
DVRS 2 - DVR parked at the desired edge of DVRS 1 Primary Range i.e. if DVRS 2 moves any farther it should also become a Primary.

1. Run Tweaker and open the RSSI Setup screen on DVRS 1.
2. Deploy DVRS 2 and ensure both units are on the same channel.
3. Select System or Local Mode in the Operating Mode Field.
4. Switch “Set Test Mode” to ON.
5. Type the ID of DVRS 2 in the Remote DVRS ID Box.
6. Set Remote Test Mode to ON. Note that both DVRS will alternate ‘WARNING 2000’ and DVR channel / mode on the top line of the control head display.
7. Press the ‘Busy Lock. Thresh. Test’ button and wait until the test is complete.
8. Note the new levels in the ‘Busy Lock. Thresh.’ and ‘Tx RSSI Thresh.’ fields. The two check boxes against those parameters will become checked to indicate test completion.
9. Press the ‘Primary Range Test’ button and wait until the test is complete.
10. Note the new level update in the ‘Rx. RSSI Thresh.’ field. The check box is checked to indicate successful test completion.
11. If any of the tests fails, please repeat the test.
12. Enter required Margins and repeat the tests for all desired channels.
13. Close the RSSI Setup screen and review the settings on the Repeater Channel Setup screen.
14. Save the data to the DVRS and dpd file as required.

Using the Tweaker Monitoring Screen

The Tweaker's Monitoring Screen is provided in order to assist the field technician with DVRS setup and troubleshooting.

The Monitoring screen provides real time indication of the RRSI level, SINAD, RF Power, PL detection etc as described below.

IMPORTANT!
It must be noted that the Monitoring screen application is not intended to replace the use of properly calibrated test equipment in the field.

Field	Description
Transmitter Mode	Can be set to either "Tx Disable" or "Tx Enable".
Tx On	Does not require user input. Used to indicated Tx On (checked) or Tx Off (unchecked)
PTT	Offers three settings: **PTT ON** – DVR keys up on selected channel and using programmed setting (channel type, PL/DPL, NAC etc) **PTT OFF** – DVR Transmitted is idle **CARRIER** – DVR Transmitter is keyed up with carrier only (no modulation). Limited to 10 minutes max key up time. **To use PTT ON or CARRIER, the "Test Mode" field must be set to YES and "Transmitter Mode" must be set to Tx Enable.**
Repeater CAS **RSSI** **Sql**	Indicates the Carrier Activated Squelch (CAS) status (Idle or Active) of the DVR with respect to the programmed RSSI and Squelch thresholds on the selected DVR channel.
RSSI	Displays the RSSI of the DVR.
PL	Displays presence of the programmed PL/DPL decoded by the DVR.
SINAD	Displays the calculated SINAD of the DVR received signal.
RF Power	Displays the DVR Tx Power when the DVR transmitter is keyed up.
Oper. State	Indicates the current DVR state – Primary, Non-Primary or Permanent Primary or OFF.
Ant. Sw.	Indicates the Antenna switch position; Normal or BL Reversed.
Mobile RUS	Provides information on when the Mobile radio is receiving a valid signal (Active or Idle).
Mobile PTT	Activated when the MSU MIC is PTT-ed.
Temp	Displays the current controller temperature.
PA_t	Displays the current PA temperature.
Test Mode	Must be set to YES in order to use the PTT or P25 Rx Modem Test options.
P25 Rx Modem Test (for test procedure see "BER Test Setup")	
Test Mode	Set to YES in order to measure BER
BER **BERm**	Displays instant (BER) and averaged (BERm) Bit Error Rate

BER Test Setup

The following is required in order to be able to measure BER on the Tweaker Monitoring Screen:

1. Connect an IFR test set or equivalent to the DVR Antenna port and set it up as described below:
    - Program TX frequency matching the programmed DVR Rx Frequency
    - PATTERN 1011
    - MODULATION P25
    - NAC 293
    - ALGID 80
    - MFID 00
    - TGID 1
    - SID 000001
2. Set the **Test Mode** AND **P25 Rx Modem Test – Test Mode** to 'YES'
3. Lower the IFR Transmit level until desired BER Threshold is observed on the Monitoring screen.

Troubleshooting

Software / Programming Related Problems

Most of the DVRS Programming problems are caused by mismatched MSU, DVR and portable radio templates. Note that any updates to the MSU or the PSU templates may require corresponding changes to be made in the DVR template.
The following error messages may be displayed on the MSU control head:

CH Display	Description / Action
INCOMP MSU HW	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.
Alternating VR ERROR and RC ERROR XXXX	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.
INCOMP MSU SW	Please contact Motorola and Futurecom to obtain compatible firmware upgrades for the radios.
WARNING 0400 **WARNING 0800**	Displayed upon power up only indicates that the Main / Backup 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 Main / Backup EEPROM Map.
RC ERROR 1000	Displayed permanently indicates that both the Main and Backup EEPROM maps are corrupted and the unit is not operational. Please contact Futurecom for further instructions on how to troubleshoot the problem.
RC ERROR 4000	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.
LOW BATTERY	Indicates Low Battery Warning or Alarm.
VR PROGRAMMING	Indicates the VR is being programmed and the MSU is on standby.
ID MISCONFIG	Indicates a PSU ID misconfiguration has been detected. Requires PSU ID change.
SYNC ERROR	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.
SCN LIST ERR	Displayed temporarily when Scan and DVR are turned ON while band locking is enabled in the DVR and the MSU scan list contains members using the same frequency band as the DVR.
TRANSL TG WRN	This warning is displayed when a talkgroup in the talkgroup translation table is active on the trunking system. The DVR (and respectively PSU) programming must be changed so that valid system TG IDs are not used for Translation.

In case of insufficient DVR Tx Power or poor sensitivity, please verify that the frequencies programmed in the DVR are within the filtering specifications as indicated on the duplexer and in-band filtering labels.
Ensure the DVR is only enabled on MSU Modes using the frequency plan for the specific DVR Model.

Firmware Upgrade

Some DVRS units which were originally shipped with older firmware may require EEPROM map upgrade after re-flashing them with newer firmware. To upgrade the EEPROM, please follow the instructions shipped with the flash upgrade.

Appendix 1 – DVR Specifications

General Specifications				
Dimensions: Height / Width / Depth	185mm (7.28") / 186mm (7.32") / 315mm (12.41")			
Weight (DVR Only, without filtering)	10.3kg (22.7lb)			
Channel Spacing	12.5 or 25 kHz programmable			
Number of Channels	Up to 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	-30ºC to +60ºC			
Protection Against Liquids	IP54			
Antenna Impedance	50 Ohms			
Duty Cycle	Continuous			
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	-20dBm			
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 de-emphasis characteristic over 300 Hz – 3 kHz			
Audio Distortion	<2%			

Appendix 2 – DVR Status Display

MSU CH 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' State (there is another Permanent Primary already present in the area)**
Steady 	**Permanent Primary DVR Receiving**
Steady 	**Permanent Primary DVR Transmitting**
Steady 	**Permanent Primary DVR Receiving and Transmitting**
VR SERVICE	**DVR is in Service Mode (during re-flashing of the firmware).**
VR ERROR	**DVR Detected Error. Display toggles between VR ERROR and the actual error code / number.**
VR IN RESET	**DVR is being reset**
VR DISABLED	**DVR Disabled on Selected MSU TG / Mode**

Appendix 3 – DVRS Features vs PSU Type

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
Registration / Deregistration	Yes	Yes [Note 1]	Yes [Note 3]
Talk Group Proxying / Translation	Yes	Yes	No
Group Calls	Yes	Yes	Yes
PSU PTT ID	Yes	Yes	Yes [Note 2]
Private Calls	Yes	No	No
Announcement Group	No	No	No
Phone Interconnect	Yes	No	No
Patch	Yes	No	No
Dynamic Regrouping	Yes	No	No
Selector Lock / Unlock	No	No	No
Emergency Call / Alarm	Yes	Yes	Yes
Emergency ID Pass through	Yes	Yes	Yes [Note 2]
PSU Hot Mic	Yes [Note 4]	No	No
PSU Emergency Revert	Yes	Yes	Yes
P25 Encryption	Yes	Yes	No
Call Alert Page	Yes	Yes	No
System Status Broadcast (Failsoft, Out Of Range, Site Trunking)	Yes	No	No
Local Mode Indication	Yes	No	No
Adaptive Power Control	Yes	Yes [Note 6]	No
Talk Permit Tones (generated by PSU)	Yes	No	No
Leading / Trailing Tones (sent over the air)	No	No	Yes
Radio Check / Radio Inhibit	Yes	Yes	No
P25 Trunking OTAR	Yes	No	No
PSU GPS	Yes	No	No
PSU SCAN	No	No	No
Remote DVR Activation by PSU	Yes (Call Alert)	Yes (Call Alert)	Yes (DTMF)
Remote DVR Activation by PSU Emergency Alarm	Yes	Yes	Yes (MDC1200)

Table 17 DVRS Features (Supported on Motorola Infrastructure) 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.
Note 5 The PSU models that can be programmed as **DVRS Enabled** are described in **Table 2.**
Note 6: Motorola Solutions XTS or APX series PSUs in non DVRS Enabled mode.

Appendix 4 – 'DVRS Enabled' PSU Features Support on 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
PSU PTT ID	Yes	Yes
In Car Monitor	Yes	Yes
MSU MIC PTT with DVRS ON	Yes	Yes
PSU Group Calls	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 GPS	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

*PCII Support only ; Enhanced Private Calls are only supported on Motorola Infrastructure.

Appendix 5 DVRS Features – P25 DVR Mode & P25 Trunking Mobile Mode

The operation described below assumes a DVR Digital Mode conventional channel and P25 Talk Group are selected on the DVR and MSU respectively. Note that some features require DVRS Enabled PSUs as described in **Table 12**.

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 via DVRS	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 GPS	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 PTT ID	No	Yes	Yes

Appendix 6 DVRS Features in P25 DVR Mode & P25 Conventional Mobile Mode

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 via DVRS	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	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 GPS	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	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

Appendix 7 DVRS Features in Forced Analog DVR Mode & Conventional Analog Mobile Mode

The features below are 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 GPS	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	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

Appendix 8 DVRS Features in Forced Analog DVR Mode & 3600 Baud Trunking (Analog or Digital) Mobile Mode

The features below are 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 GPS	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

Appendix 9 DVRS Features in Analog DVR Mode & P25 Trunking Mobile Mode

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 GPS	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

Appendix 10 DVRS Features in Analog DVR Mode & P25 Conventional Mobile Mode

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	?	?
PSU Emergency Alarm	Yes (after activation)	Yes	Yes
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
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 GPS	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

Appendix 111 DVRS Features in Analog DVR Mode & Conventional Analog Mobile Mode

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	NA	NA	NA
Inbound Call Alert	No	No	No
PSU Leading / Trailing 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	Yes (after activation)	Yes	Yes
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	NA	NA	NA
Local Mode Indication on PSU	No	No	No
DVR Primary / Secondary Voting	Yes	Yes	Yes
DVR Tones – MSU Speaker	No	Yes	Yes
PSU Radio Check / Inhibit	No	No	No
PSU GPS	No	No	No
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	NA	NA	NA
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	Yes	Yes
PSU PTT ID	No	Yes	Yes

Appendix 12 DVRS Features in Analog DVR Mode & 3600 Baud (Analog or Digital) Trunking Mobile Mode

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; uses MSU unit ID and TG)	Yes (group call, uses MSU unit ID and TG)
PSU Emergency Revert	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 GPS	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

Appendix 13 DVRS Features in Analog DVR Mode and P25 Phase II TDMA Trunking Mobile Mode

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	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 GPS	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)

Appendix 14 DVRS Features in Forced Analog DVR Mode and P25 Phase II TDMA Trunked Mobile Radio Mode

The features below are 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	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 GPS	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	Yes	Yes
Audio Buffering	No	Yes	Yes
PSU Scan	No	No	No
PSU Announcement Group	No	No	No
P25 Encryption	No	Inbound – Local only Outbound – Programmable (clear voice or tones)	Inbound – Local only Outbound – Programmable (clear voice or tones)
PSU Status / Message	No	Status only	Status only
PSU PTT ID	No	Yes*	Yes*
*PSU PTT ID is displayed on the FNE side (on system radios) but not on other local PSUs.			

Appendix 15 – Accessories

DVR Antennas – Vehicular Mount

Order Code	Freq. Band [MHz]	Type	Gain dBd
HAD4006A	136-144	Roof / Trunk Mount	0 (Unity)
HAD4007A	144-150.8	Roof / Trunk Mount	0 (Unity)
HAD4008A	150.8-162	Roof / Trunk Mount	0 (Unity)
HAD4009A	162-174	Roof / Trunk Mount	0 (Unity)
HAE6012A	380-433	Roof / Trunk Mount	0 (Unity)
HAE4003A	450-470	Roof / Trunk Mount	0 (Unity)
HAE4004A	470-512	Roof / Trunk Mount	0 (Unity)
HAF4016A	764-870	Roof / Trunk Mount	0 (Unity)

Cables

Order Code	PN	Length	Notes
DDN9028	7W083X05-01	3ft	DVR-to- MSU Control Cable. Custom lengths available – up to 25ft.
DDN9029	1W083B09-01	3ft	Replaces 1 if a Siren is to be interfaced to the MSU.
DDN9030	1W083A01-01	-	DVR Power Cable
DDN9031	7W083X06-01	2.5ft	Options Cable.
DDN9034	7W083X17-01	3ft	MSU to In-Band Filtering RF Cable
DDN9032	7W083X09-01	1ft	RF switch option cable
DDN9033	7W083X16-01	3ft	DVR to In-Band Filtering RF Cable
DDN9025	USBAB99	10ft	USB DVR Programming / Re-flashing Cable

Contact Information

Technical Support

905-660-5548
support@futurecom.com

Orders

Please contact Motorola / Drop Ship

Return Authorizations

1-800-701-9180

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U

Glossary

Keyword	Description
ACK	Acknowledgement of communications.
AVRA	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 provided with the DVRS hardware.
Band Lock	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.
BL	Busy Lockout – dynamic voting phase (follows the static Primary / Secondary phase) of the DVR simulcast prevention algorithm.
Channel	A group of characteristics, such as transmit / receive frequency pairs, radio parameters, encryption encoding etc.
Coded Squelch	Tone Private-Line (PL) or Digital Private-Line (DPL). Used on conventional channels for signal validation.
Conventional	Refers to radio-to-radio communications, sometimes through a base station repeater or vehicular repeater.
Dispatcher	An individual who has radio system management duties.
DPD File	DVR personality file saved as **file_name.dpd**.
DPL Coded Squelch	A continuous sub-audible data signal transmitted with the carrier. See Coded Squelch.
DVR	Digital Vehicular Repeater.
DVR Mode	Determines the communication exchange capabilities between System Users and Local Portable Users; Can be set to OFF, LOCAL or SYSTEM.
DVRS	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. **This document only described the APX interfaced DVR.**
'DVRS Enabled' PSU	P25 XTS™1500, XTS™2500, XTS™5000, APX™4000, APX™6000 or APX™7000 Portable Radio with enabled DVRS operation.

Keyword	Description
EPR File	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.
FCC	Federal Communications Commission.
FNE	Fixed Network Equipment – Trunking or Conventional System Infrastructure
Forced Analog Mode	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 a non-P25 channel / TG is selected on the MSU. When a P25 channel / TG is selected on the MSU the DVR operates in Digital mode. Applicable only to 'DVRS Enabled' PSUs.
Heart Beat	P25 Message periodically sent by a Primary DVR to other DVRs during Primary/Secondary processing.
HUB	Hang Up Box – refers to the MSU Microphone being on hook or off hook.
ICM	In Car Monitor – when enabled in the MSU, allows the MSU user to monitor voice traffic to and from the local PSU
Inbound Call	A Call transmitted by Local PSU and received by the DVR.
Local Mode	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.
Local PSU	PSU switched to the DVR channel and used for communication with the DVR
Local Tx Fallback	When enabled, the MSU reverts to local call if the MSU fails to access the system.
Mode	**MSU / PSU** - A programmed combination of operating parameters. **DVR** – OFF, SYSTEM or LOCAL (see **DVR Mode**)
MPE	Maximum Permissible Exposure.
MSU	Mobile Subscriber Unit

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

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