MOBEXCOM P25

DIGITAL VEHICULAR REPEATER

FUTURECOM
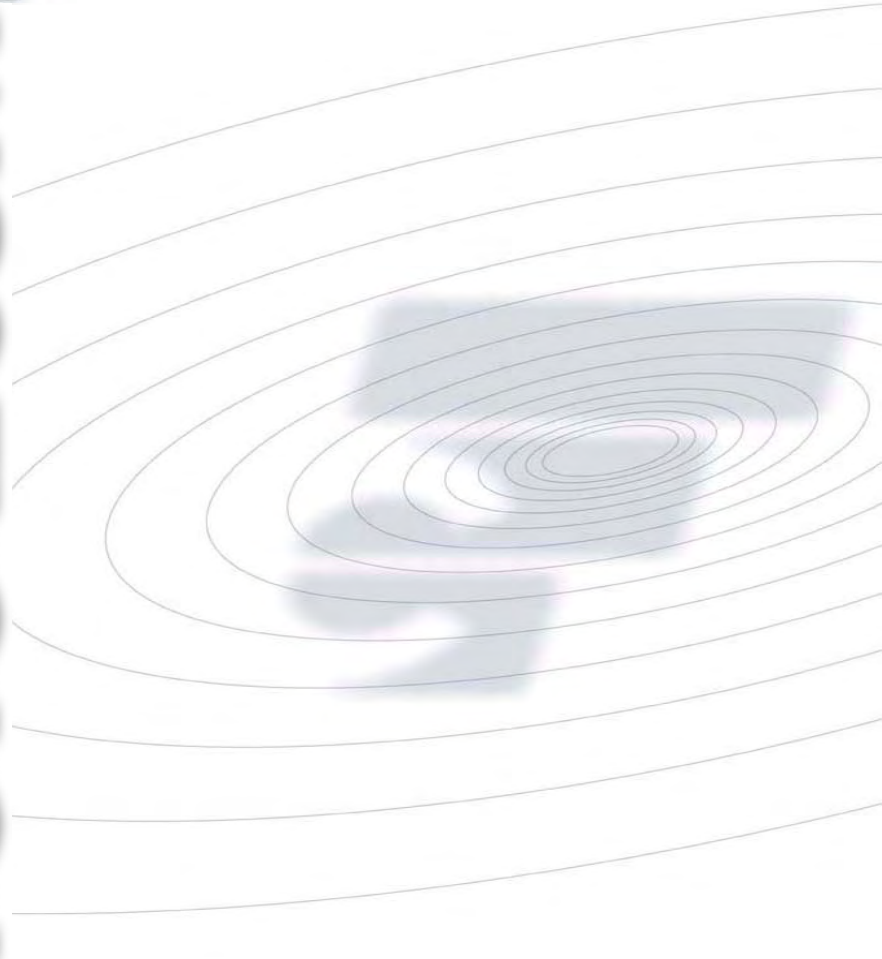
Functional Description

8K083X01 Rev. 6

NOTES

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Manual Revisions

Revision #	Date	ECN	Notes & References
0	01/14/2006	na	Original Release
1	01/25/2006	06037	Various format updates
2	02/14/2006	06046	Table 3 updated
3	03/03/2006	06068	380-403MHz model added
4	04/28/2006	06098	Merged 380-430MHz model
5	06/08/2006	06132	Full Duplex option availability reference added
6	07/07/2006	06157	Phase II features expanded - preliminary

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Introduction

The Mobexcom P25 DVRS allows portable radios to be used in areas where only Mobile Radio coverage is available and portable radio coverage is either intermittent or non existent.

Installed in the trunk of a car, fire truck, armored vehicle, ambulance or configured as a Transportable or Fixed mount DVR, the Mobexcom P25 extends radio communications when the portable users are outside of the vehicle, inside a nearby building or in any portable radio marginal coverage areas.

PORTABLE RADIO COVERAGE RANGE

DVRS Extends Portable Radio Communications in RF Shielded Areas.

MOBILE RADIO COVERAGE RANGE

DVRS Extends Portable Radio Communications in Areas where only Mobile Radio Coverage is available.
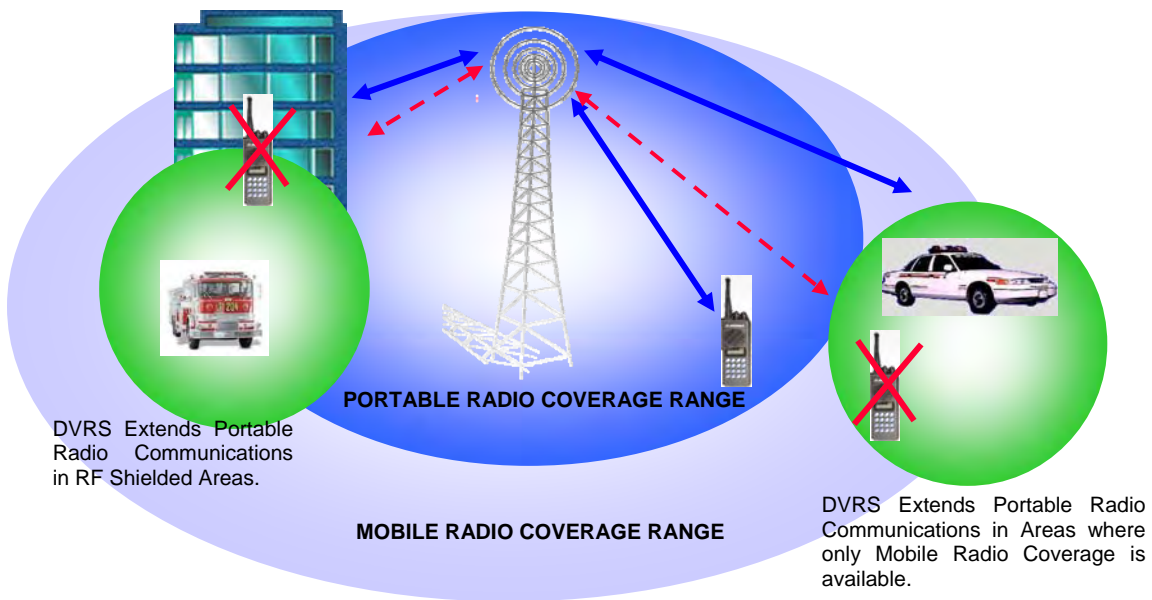
Figure 1 Portable Radio Coverage Extension with In-Band DVRS

The most popular use of the DVRS is in In-Band Applications (see Figure 1). The same portable radio is used to communicate directly with the System as well as through the DVRS. Whenever System radio coverage is not available, the portable radio users can switch to a DVRS channel and communicate via a nearby active DVRS.

The P25 DVRS can also be used in Cross-Band Systems, where all Portable Radio Coverage is provided via the DVRS. Some Cross-Band applications may require the use of two portable radios – type 1 (operating on Frequency Band 1) for direct use on the System and type 2 (operating on Frequency Band 2) for use via the DVRS when the type 1 is out of system radio coverage. However, the most typical Cross-Band DVRS scenario is as shown on Figure 2 – when the entire portable radio coverage is provided via DVRS.

Band 1

Band 1

Band 2 Portable Radio Coverage Through DVRS

Band 2 Portable Radio Coverage Through DVRS

MOBILE RADIO COVERAGE RANGE – Band 1
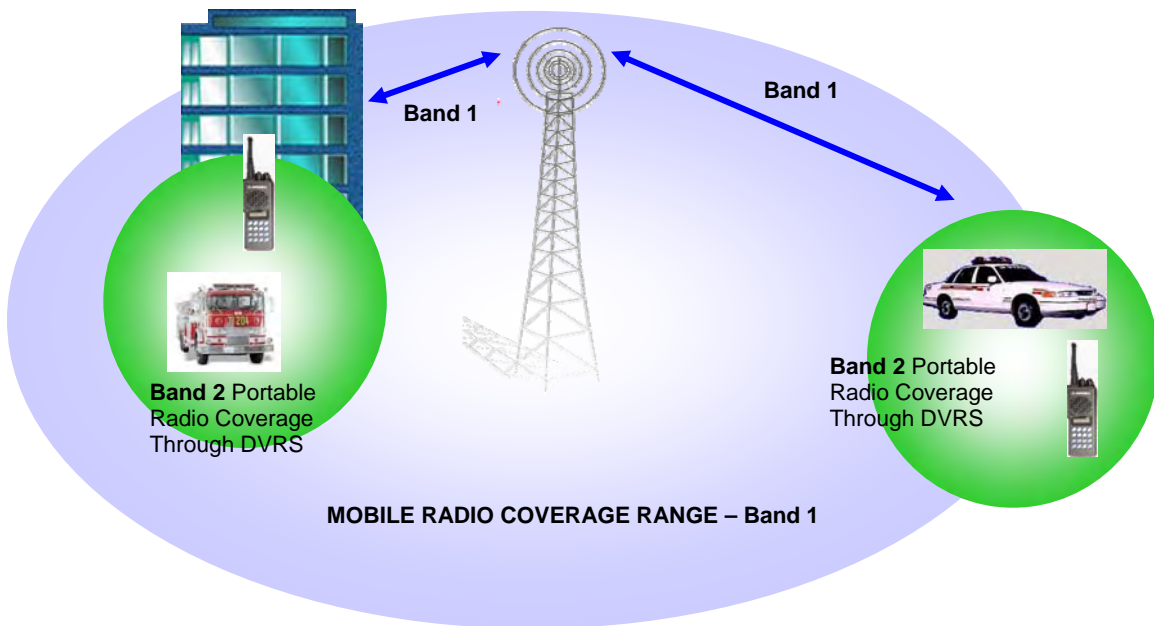
Figure 2 Portable Radio Coverage Extension with Cross-Band DVRS

The DVR not only extends voice (clear or encrypted) communications but it also supports key trunking system features and can be configured to provide various advanced options to the Users.

DVRS Principle of Operation
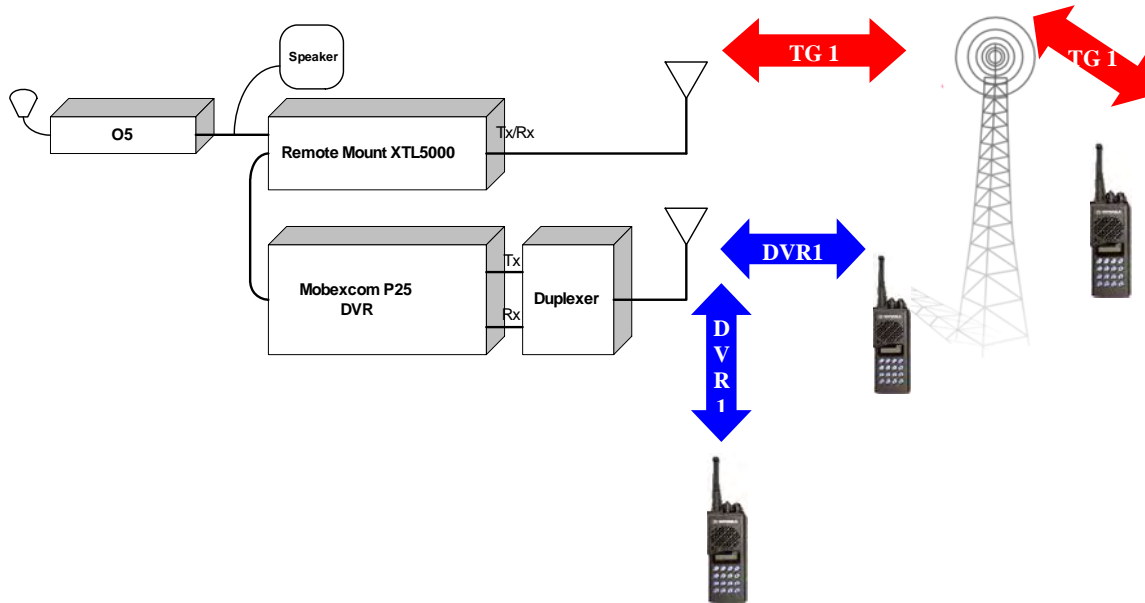
Figure 3 DVRS Conceptual Diagram

The P25 DVR is a versatile, full duplex digital repeater, designed to be seamlessly interfaced to a Remote Mount XTL5000 Digital Mobile Radio using O5 Control Head.
W – Series control heads are NOT supported by the DVRS.
The DVRS is controlled from (and its status is displayed on) the O5 Control Head. It is equipped with all necessary filtering for interference-free operation.

When the DVRS is activated, any Outbound Calls (Mobile radio receiving on the selected TG 1) can be repeated to the Local Portable radios over the selected DVR conventional digital or conventional analog channel DVR1 – see Figure 3.
Local Portables can communicate with each other over DVR1 as well as to the System Users on TG 1.
In-car monitor will be supported in Phase II.

NOTES:
Phase I – DVRS and XTL5000 Firmware Released in Q1 2006.
Phase II – Scheduled DVRS and XTL5000 Firmware Release in Q4 2006.
Full Duplex Option Availability for a particular frequency band configuration needs to be confirmed at the time of order.

DVRS Compatibility

The following table summarizes the DVRS compatibility scenarios:

PSU MODE	MSU MODE			
	Conventional Analog	Conventional Digital P25	3600 Analog 3600 Digital Trunking	9600 Digital P25 Trunking
Conventional Analog	Yes	Phase II	Phase II	Yes
Conventional Digital P25	No	Phase II	No	Yes
Conventional Digital P25 DVRS Enabled	No	Phase II	No	Yes
3600 Analog Trunking 3600 Digital Trunking	No	No	No	No
9600 Digital Trunking	No	No	No	No

Table 1 DVRS Compatibility Scenarios

IMPORTANT!
XTL5000 Interfaced DVRS requires the following: XTL5000 must be equipped with firmware release 7.00.00 or later. O5 Control Head must be equipped with firmware release 2.00.00 or later.

Mobile Radio Type	Control Head	Projected DVRS Availability
XTL5000	O5	Available
XTL5000	O3	Phase II
XTL2500	M5	Phase II

Table 2 DVRS Interface Availability

DVRS Models

Frequency Band of Operation

Depending on the frequency band of operation of the XTL^{TM} 5000 and the interfaced DVR, the DVRS models are classified as follows:

- **In-Band** – when the XTL^{TM} 5000 and DVR operate in the same frequency band.
- **Cross-Band** – when the XTL^{TM} 5000 and DVR operate in two different frequency bands.

In-Band

The following **In-Band DVRS Model Groups** are available:

	DVR BAND OF OPERATION [MHz]					
	136-174	380-430	450-470	470-512	764-776 794-806	806-825 851-870
XTL^{TM} 5000 *BAND OF OPERATION [MHz]*	136-174	380-470 OR 450-520	380-470 OR 450-520	380-470 OR 450-520	762-776 794-806 OR 806-825 851-870	762-776 794-806 OR 806-825 851-870

Table 3 In-Band DVRS Models
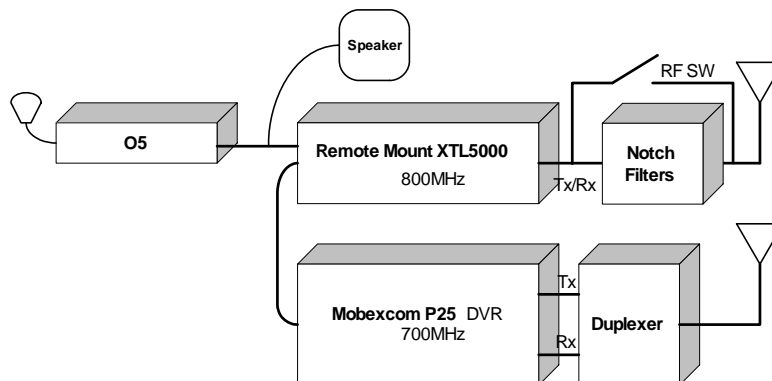
Figure 4 Typical In-Band DVRS Setup

The In-Band DVRS is equipped with two sets of filters (Figure 4):

- An internal duplexer, providing the necessary isolation between the DVR Transmit and Receive Frequencies, as well as rejecting the Mobile radio frequencies.
- An in-band filter installed at the output of the Mobile Radio, rejecting the DVR transmit and Receive Frequencies.

An RF Bypass switch bypasses the in-band filter when a 'VR Disabled' mode is selected on the O5. When a 'VR Enabled' mode is selected on the O5, the in-band filters are switched in to ensure interference free operation.

> **Important:**
> **Minimum 30 dB antenna isolation must be provided in order to ensure interference-free operation of both the Mobile Radio and the DVR.**

Cross-Band

The following **Cross-Band DVRS Model Groups** are available:

	DVR BAND OF OPERATION [MHz]					
	136-174	**380-430**	**450-470**	**470-512**	**764-776 794-806**	**806-825 851-870**
XTL™ 5000 *BAND OF OPERATION* [MHz]	380-470 OR 450-520 OR 762-776 794-806 OR 806-825 851-870	136-174 OR 762-776 794-806 OR 806-825 851-870	136-174 OR 762-776 794-806 OR 806-825 851-870	136-174 OR 762-776 794-806 OR 806-825 851-870	136-174 OR 380-470 OR 450-520	136-174 OR 380-470 OR 450-520

Table 4 Cross-Band DVRS Models
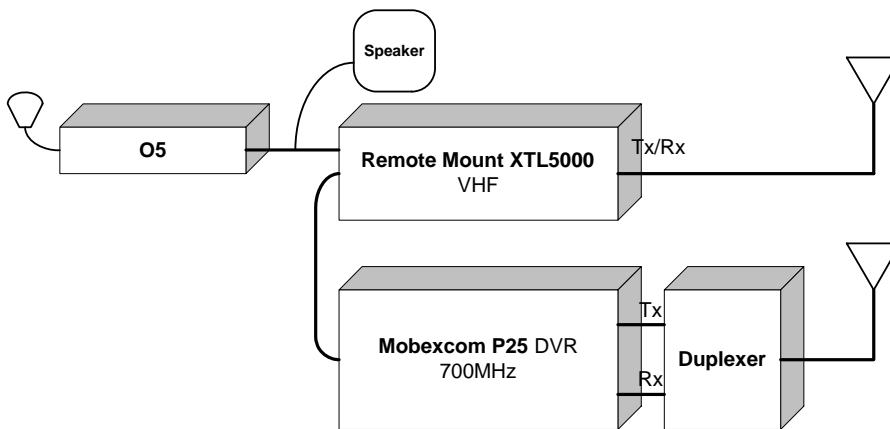
Figure 5 Typical Cross-Band DVRS Setup

The Cross-Band DVRS is equipped with a high selectivity duplexer, providing the isolation necessary for Full Duplex operation.

Important!
Minimum 30 dB antenna isolation must be provided in order to ensure interference-free operation of both the Mobile Radio and the DVR.

Important!
The DVRS is equipped with very selective filtering tuned to customer specified frequencies. For more information on the available frequency plans and associated restriction, pleased refer to the DVRS Ordering Guides – Documents 8A083X10, 8A083X11, 8A083X12, 8A083X13, 8A083X14, 8A083X15.

DVRS Mounting Arrangement

Side-By-Side DVRS

Side-By-Side mounting is the standard option for vehicular type installations. The Cross-Band DVRS package includes a DVR Repeater and Duplexer Enclosure, mounted on one side and a Remote Mount XTL^{TM} 5000 Radio mounted next to the DVR.
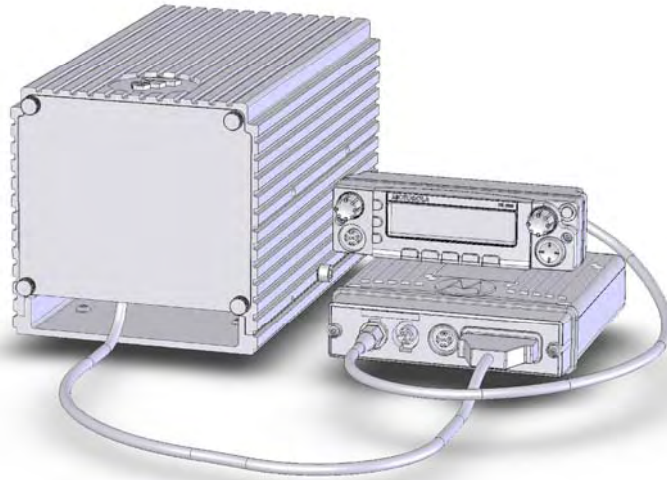
Figure 6 Typical Cross-Band DVRS Layout

The In-Band models are comprised of a DVR Repeater and its associated filtering shelves mounted on one side, a model-specific in-band filtering shelf (shelves) mounted as close as possible to the DVR and a Remote Mount XTL^{TM} 5000 Radio mounted next to the in-band filtering.
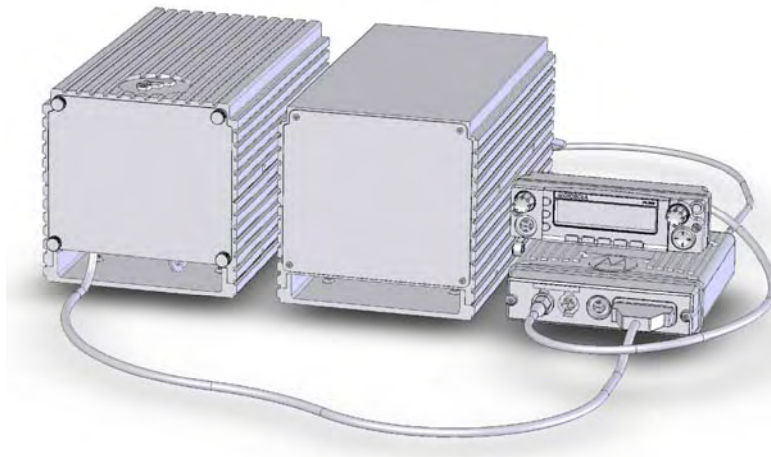
Figure 7 Typical In-Band DVRS Layout - VHF

NOTE
The DVR and XTL^{TM} 5000 always require two separate antennas.
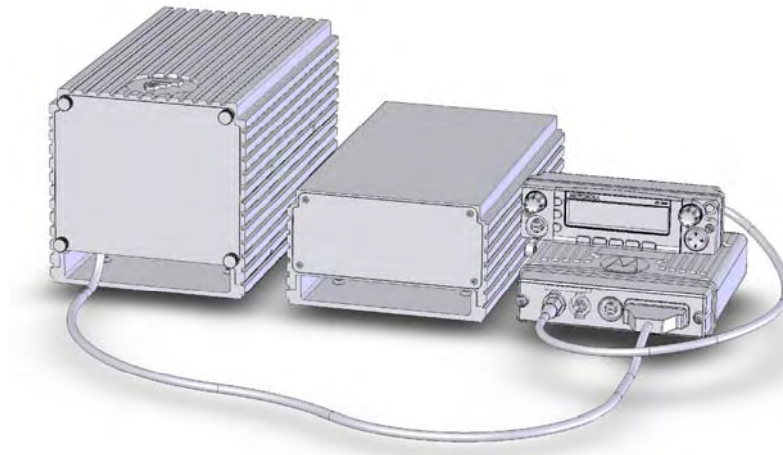
Figure 8 Typical In-Band DVRS Layout - 700 or 800 MHz

Transportable DVRS

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

The battery backup kit is also packaged in a suitcase for ease of transportation.

The Transportable Model requires two antennas - one connected to the XTL^{TM} 5000 and one to the DVR.

The XTL^{TM} 5000 antenna needs to be strategically deployed in order to ensure reliable link between the XTL^{TM} 5000 and the P25 Radio System.

The DVR antenna needs to be positioned to provide optimum radio coverage for the portable radio users. For further details, please refer to publication 8F083X02.

Fixed DVRS

The Fixed DVRS model is housed in a wall-mount indoor enclosure and includes all necessary electronics and filtering. The Fixed DVRS is intended for permanent i.e. 'Fixed' type installations. For further details, please refer to publication 8F083X01.

Fixed DVRS   **Transportable DVRS (TDVRS)**   **Battery Pack for TDVRS**

DVRS Features vs PSU Type

Depending on the type of portable radios used, the following DVRS features may be available if enabled by the programmed personalities of the DVR, Portable Subscriber Unit (PSU) and Mobile Subscriber Unit (MSU):

DVRS FEATURE	XTS 5000 DVRS Enabled P25 PSU	Generic P25 PSU	Analog PSU
REGISTRATION / DEREGISTRATION	Yes	Yes*	No
GROUP CALL	Yes	Yes	Yes
PRIVATE CALL	Yes	No	No
EMERGENCY CALL/ALARM	Yes	Yes	Yes
ENCRYPTION	Yes	Yes	No
CALL ALERT PAGING	Yes	Yes	No
FAILSOFT	Yes	No	No
OUT OF RANGE	Yes	No	No
SITE TRUNKING	Yes	No	No
TALK PERMIT TONES (GENERATED BY PSU)	Yes	No	No
TALK PERMIT TONES SENT BY DVR	No	No	Yes
RADIO INHIBIT	Yes	Yes	No
RADIO CHECK	Yes	Yes	No

Table 5 DVRS Features vs Type of PSU

* Generic P25 PSU registers upon first Group Call after switching to DVR mode.

DVRS Operation and Basic Features

DVRS Status Display

The DVRS Status is displayed on the O5 as follows:
The DVRS current mode and channel alias are displayed on the top line (for example VR SYS CHAN1).
The DVR Icons change to indicate the DVRS status (Master / Slave / Permanent Master) as well as the RF activities involving the DVRS (DVR Receiving, DVR Transmitting, DVR Receiving and Transmitting).

DVR Status & Icon

Activating the DVRS via the 05 Control Head

VRS Soft Key

The DVRS mode of operation and status can be changed from the 'VRS' soft key. The DVRS channel can be controlled by pressing the VRS Soft Key and subsequently turning the Rotary mode control knob.

Automatic DVRS Activation (AVRA)

The DVR can be activated automatically if one of the VIP inputs on the MSU control head is wired to the desired trigger source – portable charger switch or door switch or custom manual switch.

When the DVR is in the OFF mode and the VIP input is asserted by the installed trigger, the DVR will automatically switch to the SYSTEM mode.

For instance, removing the portable radio from the charger before leaving the vehicle may be set up to automatically activate the DVR (i.e. switch it to System Mode).

If the DVR is in the SYSTEM or LOCAL mode, asserting the VIP output through the installed trigger switch will not cause any change of the DVR status.

If the DVR is in the SYSTEM or LOCAL Mode and the AVRA VIP input is de-asserted, the DVR will switch to OFF Mode.
If the DVR is in the OFF Mode, de-asserting the AVRA VIP will not result in any change.
The method of de-asserting the AVRA VIP depends on the actual installed trigger.

For example, if the selected AVRA trigger is the Portable Charger Switch, de-asserting the AVRA VIP input is equivalent to placing the PSU back in the charger.

Remote Activation of the DVRS

Via PSU Call Alert

To remotely activate a DVR, the PSU user can send a Call Alert Page with the ID of the specific DVR.
Upon receipt of a Call Alert Page from the PSU the DVR will:

- Switch from OFF or LOCAL mode to SYSTEM Mode (unless it is already in the SYSTEM Mode).
- Switch to Master Status and force any other Master DVR to become a Slave unless there is a Permanent Master (on the same DVR channel) already present in the same area.
- Force the MSU to revert to the TG selected on the PSU (if enabled by the DVR and PSU programming).

Via PSU Emergency Call / Alarm

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

Inactivity Timer

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

'DVRS Enabled' Mobile Radio TGs / Channels

DVR Operation may be enabled (by the DVR and MSU programming) on selected Mobile Radio Talk Groups / Channels and disabled on others.

When the User selects a DVRS Enabled TG / Channel on the O5 Control Head, the DVR Operation is enabled in the following manner:

- The DVR automatically enters the pre-programmed DVR Mode/Channel associated ('slaved') with the selected MSU TG / Channel if DVR Slaved Operation is programmed in the DVR.

OR

- The User may change the DVR Mode / Channel (if 'slaving' is not enabled) by pressing the assigned VRS Button and entering the DVR Control Mode.
- The DVR can be activated and used to repeat messages between the System Users of the TG/Channel Selected on the MSU O5 and the PSU users on the Selected DVR Channel.
- If enabled in the DVR personality, 'DVR Enabled' tones will be heard every few seconds (5-255 sec. programmable) in the MSU speaker, regardless of the Master / Slave status.

'DVRS Disabled' Mobile Radio TGs / Channels

DVR Operation may be enabled on selected Mobile Radio Talk Groups / Channels and disabled on others.

When the User selects a "DVRS Disabled" TG / Channel on the O5 Control Head:

- **VR DISABLED** message appears on the O5 display.
- Pressing the VRS button results in a DVR Invalid Option Tone (single low-pitched tone).
- DVR Operation is prohibited i.e. all DVR functions are disabled.

DVRS Modes of Operation

When a "DVRS Enabled" TG / Channel is selected on the O5 Control Head, the DVR can be switched to one of the following Modes – OFF, LOCAL or SYSTEM.
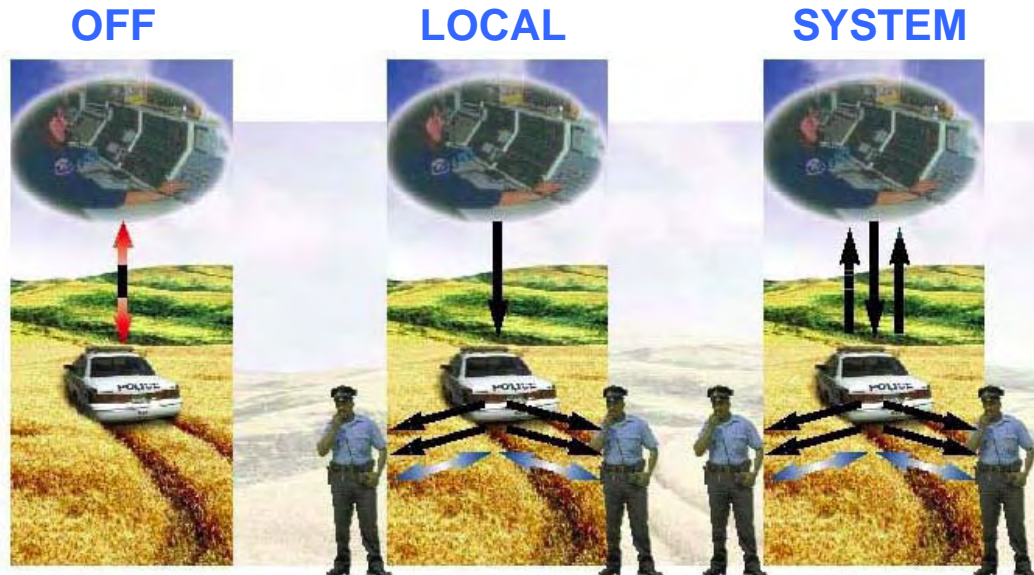
OFF mode is used when the DVRS repeat is not required (for example while the portable user is in the vehicle driving).

LOCAL mode is used in some tactical applications when only portable-to-portable communications are required. Inbound calls are not repeated to the System in the **LOCAL** mode i.e. the calls received by the DVRS are repeated locally but the Mobile Radio does not key up.
As an option, the DVRS can be programmed to repeat System outbound calls to the local portable users.

SYSTEM mode enables the full DVRS repeat – locally and to the System. Outbound calls received by the Mobile Radio are repeated by the DVRS to the local portables over the DVRS channel. Inbound calls received by the DVRS are repeated locally (portable-to-portable) as well as to the System users (by keying up the Mobile Radio).

OFF Mode Operation

ACTIVITY	OFF MODE ACTION
O5 Display	VR OFF <DVR CH Name>
VRS Button Press	Short high-pitched tone. DVR Control Mode is accessible.
MSU Receiving from System on Selected MSU TG/Channel	DVR does not repeat audio received by MSU. Speaker Audio present.
MSU User PTTs the MSU Microphone	MSU Keys up. DVR does not key up.
PSU Activity on DVR channel	DVRS Transmit Function Disabled i.e. No DVR repeat. No Speaker Audio.

Table 6 OFF Mode DVRS Basic Operation

System Mode Operation

ACTIVITY	SYSTEM MODE ACTION
O5 Display	VR SYS <DVR CH Name>
DVRS Active Tones	If programmed, a short high-pitched 'DVR Enabled' tone is repeated every 10 seconds (5-255 sec. programmable) in the MSU Speaker regardless of the Master / Slave Status of the DVR.
VRS Button Press	Short high-pitched tone. DVR Control Mode is accessible.
MSU User PTTs the MSU Microphone	**Phase I**: DVR does not key up. MSU keys up. **Phase II**: Both DVR and MSU key up.
MSU Receiving from System on Selected MSU TG/Channel	DVR repeats audio received by MSU to PSU Users of the designated DVR Channel. Speaker Audio present.
PSU Activity on DVR channel	PSU audio is repeated locally by DVRS as well as by the MSU to the System (on the selected TG). No Speaker Audio in Phase I. Programmable In-Car Monitor in Phase II.

Table 7 SYSTEM Mode DVRS Basic Operation

NOTE
If the selected DVR TG / channel attribute is programmed as an Extender or in Simplex mode the local repeat DVR function is not available.

Local Mode Operation

ACTIVITY	LOCAL MODE ACTION
O5 Display	VR LOC <DVR CH Name>
DVRS Active Tones	If programmed, a short high-pitched 'DVR Enabled' tone is repeated every 10 seconds (5-255 sec. programmable) in the MSU Speaker regardless of the Master / Slave Status of the DVR.
VRS Button Press	Short high-pitched tone. DVR Control Mode is accessible.
MSU Receiving from System on Selected MSU TG/Channel	DVR may be programmed to repeat audio received by MSU to the PSU Users over the DVR Channel when the DVR is idle. Speaker Audio present.
MSU User PTTs the MSU Microphone	**Phase I**: DVR does not key up. MSU keys up. **Phase II**: DVR keys up. MSU does not key up.
PSU Activity on DVR channel	PSU audio is repeated locally by DVRS. No Speaker Audio in Phase I. Programmable In-Car Monitor in Phase II.

Table 8 LOCAL Mode DVRS Basic Operation

Selecting DVRS Mode

When a 'DVRS Enabled' TG / Channel is selected on the MSU, the User may change the DVRS Mode / Channel / Status by entering the 'DVRS Control Mode' (VRS soft key press).

The DVRS Mode and Channel may be programmed to be 'Slaved' to the specific MSU TG/Channel.
In this case, selecting a specific MSU TG / Channel on the O5 Control Head would automatically force the DVR to revert to a pre-programmed DVR Mode and/or Channel.

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

If enabled in the specific DVR personality programming, the DVRS User can still toggle the DVR Mode by pressing the VRS Button and entering the 'DVR Control Mode'.

If Mode change by the User is prohibited in the specific DVRS personality, the User can only select between the 'Slaved' (either LOCAL or SYSTEM) and OFF DVR Modes.

Selecting DVRS Channel

When a 'DVRS Enabled' TG / Channel is selected on the MSU, the User may change the DVRS Channel by entering the 'DVRS Control Mode' (VRS soft key press) and then turning the Rotary mode selector.

The DVRS Mode and Channel may be programmed to be 'Slaved' to the specific MSU TG/Channel.

In this case, selecting a specific MSU TG / Channel would automatically force the DVR to revert to a given DVR Channel and/or Mode.

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

Master / Slave DVR Basics

In order to prevent interference and loss of communications when more then one active DVRS are present at the same location and tuned to the same DVR Channel, a sophisticated simulcast prevention algorithm is employed to ensure only one DVRS repeats radio communications on the same DVR frequency at the same time.
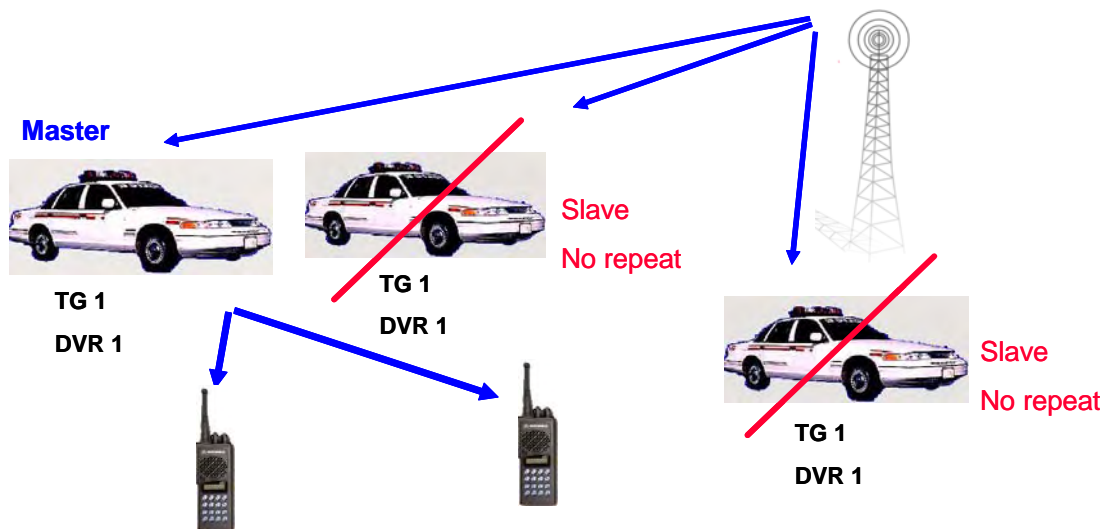
Figure 9 Simulcast Prevention (Master / Slave) Typical Scenario

While the algorithm is transparent to the User, on some occasions he/she may need to be able to select (or simply be aware of) which DVRS is currently the 'Master' and which ones are 'Slaves'.
Furthermore, a DVRS may be assigned to be a Permanent Master if this selection is enabled in the programmed personality. A Permanent Master always wins the voting algorithm.
If more then one Permanent Masters are activated simultaneously, they vote to ensure only one DVR remains as a Permanent Master and the other(s) revert to Slave status.

The simulcast prevention algorithm ensures that there will always be one active Master DVRS regardless of when any of the DVRS arrive / leave the scene or are switched ON/OFF.

	MASTER	SLAVE	PERMANENT MASTER
DEFINITION	An active DVR which has won the voting selection and has been selected to repeat Local PSU or System Communications.	An active DVR which was voted off and forced to stay on stand-by, without repeating for as long as the elected Master DVR is servicing the communication needs in the area.	An active DVR, which is forced by the User or programmed to act as a Master. The Permanent Master forces all other DVRs in the area to assume Slave status. If more then one Permanent Masters are available in the same area, they will go through higher level voting to elect one winning Permanent Master among them.
SELECTION	Transparent to the User Selection via DVRS voting algorithm.	Transparent to the User Selection via DVRS voting algorithm.	Long press (3s) of the VRS button on the O5 Control Head toggles the Permanent Master Status ON and OFF if Permanent Master is enabled in the DVR programmed personality.
O5 DISPLAY	Steady V∶R	Flashing V∶R	Steady V∶R

Table 9 Master / Slave Definitions

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

Multiple DVRS Operation on Different DVR Frequencies

If more then one DVRS are present at the same location at the same time and they are set to operate on different DVR channels, the DVRs will operate completely independently.

For example, DVRS A may be set to operate on DVR CH 1 and TG X while DVRS B may be set to DVR CH 2 and TG Y.

Local PSU User can select DVR CH 1 and talk to TG X Users through DVRS A.

Local PSU User can select DVR CH 2 and talk to TG Y Users through DVRS B.

Both DVRS A and DVRS B will be Masters i.e. each DVRS will be the Master of its selected DVR channel.

NOTE
The above described DVRS independent operation may be very useful for some multi-agency operation scenarios.

Siren

To connect a Siren to a DVR equipped Mobile Radio, a special interface cable is required. Refer to the DVRS Ordering Guides for part number information - Documents 8A083X10, 8A083X11, 8A083X12, 8A083X13, 8A083X14, 8A083X15.

DVRS – P25 Digital Mode Operation

The operation described below assumes a DVR Digital Mode channel and a P25 Talk Group are selected on the DVR and XTL5000 respectively.

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on the O5	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	NO	YES	YES
Outbound Group Call	NO	YES	YES
Outbound Private Call	NO	YES	YES
Microphone PTT (MSU)	YES	Phase I NO – on DVR side YES – System side Phase II YES	Phase I NO – on DVR side YES – System side Phase II YES – DVR Side NO – System side
Inbound Group Call	NO	YES	YES
Inbound Private Call	NO	YES	YES
Inbound Call Alert	NO	YES	YES
Inbound Emergency Alarm / Call	YES	YES	YES
Steering	YES	YES	YES
Multiple Talk Groups	NO	Phase II	Phase II
Failsoft	NO	YES	NO
Out of Range	NO	YES	NO
Site Trunking	NO	YES	NO
Master / Slave Voting	NO	YES	YES
DVRS Status Tones – MSU Speaker	NO	YES	YES
DVRS Status Tones - PSU	NO	YES	YES
Radio Inhibit	NO	YES	YES
Radio Check	NO	YES	YES
Scan	YES	Phase II	NO
Talk Permit Tones	NO	YES	YES
OTAR	NO	Phase II	Phase II
Fire Ground	NO	Phase II	Phase II
Patch	NO	Phase II	Phase II
Dynamic Regrouping	NO	Phase II	Phase II
Phone	NO	Phase II	Phase II
Remote DVRS Activation / Deactivation	Phase II	Phase II	Phase II
Adaptive Power Control	NO	Phase II	Phase II
Emergency MDC1200 ID pass through	NA	NA	NA
Encryption	NO	YES	YES

Table 10 Digital DVRS Mode Features - P25 ASTRO Trunking Mobile

> **NOTE**
> Phase II features listed are preliminary.

The operation described below assumes a DVR Digital Mode channel and Conventional Digital Mode are selected on the DVR and the XTL5000 respectively.
All Features listed below are planned for Phase II release and are subject to change.

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on the O5	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	NO	Phase II	Phase II
Outbound Group Call	NO	Phase II	Phase II
Outbound Private Call	NO	Phase II	Phase II
Microphone PTT (MSU)	Phase II	Phase II	Phase II – DVR Side NO – System side
Inbound Group Call	NO	Phase II	Phase II
Inbound Private Call	NO	Phase II	Phase II
Inbound Call Alert	NO	Phase II	Phase II
Inbound Emergency Alarm / Call	Phase II	Phase II	Phase II
Steering	Phase II	Phase II	Phase II
Multiple Talk Groups	NO	Phase II	Phase II
Failsoft	NO	NO	NO
Out of Range	NO	NO	NO
Site Trunking	NO	NO	NO
Master / Slave Voting	NO	Phase II	Phase II
DVRS Status Tones – MSU Speaker	NO	Phase II	Phase II
DVRS Status Tones - PSU	NO	Phase II	Phase II
Radio Inhibit	NO	Phase II	Phase II
Radio Check	NO	Phase II	Phase II
Scan	Phase II	Phase II	NO
Talk Permit Tones	NO	Phase II	Phase II
OTAR	NO	Phase II	Phase II
Fire Ground	NO	Phase II	Phase II
Patch	NO	Phase II	Phase II
Dynamic Regrouping	NO	NO	NO
Phone	NO	NO	NO
Remote DVRS Activation / Deactivation	Phase II	Phase II	Phase II
Adaptive Power Control	Phase II	Phase II	Phase II
Emergency MDC1200 ID pass through	NO	NO	NO
Encryption	NO	Phase II	Phase II

Table 11 Digital DVRS Mode Features - P25 ASTRO Conventional Mobile

> **NOTE**
> Both **CLEAR** and **ENCRYPTED** calls are supported by the DVRS.

> **NOTE**
> If the selected DVR TG / channel attribute is programmed as an Extender or Simplex mode, the local repeat DVR function is not available.

Remote Steering – Phase I

In Phase I a Local PSU User can send a Call Alert Page to a specific DVRS and execute a remote change of the following:

- DVR Mode – from OFF or LOCAL to SYSTEM
- DVR Status – from SLAVE to MASTER
- DVRS TG – from the originally selected on the O5 TG to the TG selected by the Local PSU.

Multiple Talk Group Operation – Phase II

In Phase II, the PSUs will be capable of transparently accessing the System through the DVR on different Talk Groups without any need for changing the Talk Group selected on the XTL5000 (i.e. without any need for Call Alert Talk Group Steering).

System Status Reporting

The following System Status Reporting Functions are passed to the PSUs through the DVRS when SYSTEM Mode is selected:

- Failsoft
- Out of Range
- Site Trunking

Remote PSU Status

The following Functions are passed to the PSUs through the DVRS when SYSTEM or LOCAL Mode is selected:

- Radio Inhibit
- Radio Check

Patch – Phase II

When several talk groups are patched on the system side, the DVRS ensures the patching is matched on the local portables side.

Dynamic Regrouping – Phase II

The system Dispatcher can temporarily assign selected individual radios operating on different talk groups to operate on a new talk group. The DVRS extends this functionality to the local portables.

Phone Interconnect – Phase II

The DVRS supports the transmission of a message initiated by a Local portable through the telephone system. This feature is only supported over P25 Trunking System infrastructure.

Fire Ground – Phase II

The DVRS repeats locally Fireground signaling.

ASTRO OTAR – Phase II

The DVRS facilitates ASTRO OTAR transmissions between the System and the local portables.

DVRS Remote Activation / Deactivation – Phase II

The DVRS can be remotely activated / deactivated by the Dispatcher by changing the DVRS mode.

Adaptive Power Control – Phase II

The DVRS sends messages to the local portables to adjust their transmit power depending on the received signal strength.

DVRS – Analog Mode Operation

The operation described below assumes a DVR Analog Mode channel and P25 Talk Group are selected on the DVR and the XTL5000 respectively.

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on the O5	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	NO	NO	NO
Outbound Group Call	NO	**YES**	**YES**
Outbound Private Call	NO	NO	NO
Microphone PTT (MSU)	**YES**	**Phase I** NO – on DVR side **YES** – System side **Phase II** **YES**	**Phase I** NO – on DVR side **YES** – System side **Phase II** **YES** – DVR Side NO – System side
Inbound Group Call	NO	NO	NO
Inbound Private Call	NO	NO	NO
Inbound Call Alert	NO	NO	NO
Inbound Emergency Alarm / Call	**YES**	**YES**	**YES**
Call Alert / Steering	NO	NO	NO
Call Back	NO	NO	NO
Failsoft	NO	NO	NO
Out of Range	NO	NO	NO
Site Trunking	NO	NO	NO
Master / Slave Voting	NO	**YES**	**YES**
DVRS Status Tones – MSU Speaker	NO	**YES**	**YES**
DVRS Status Tones - PSU	NO	**YES**	**YES**
Radio Inhibit	NO	NO	NO
Radio Check	NO	NO	NO
Scan	**YES**	NO	NO
Talk Permit Tones	NO	**YES**	**YES**
OTAR	NO	NO	NO
Fire Ground	NO	NO	NO
Patch	NO	NO	NO
Dynamic Regrouping	NO	NO	NO
Phone	NO	NO	NO
Remote DVRS Activation / Deactivation	**Phase II**	**Phase II**	**Phase II**
Adaptive Power Control	NO	NO	NO
MDC1200 ID pass through	**Phase II**	**Phase II**	**Phase II**
Encryption	NO	NO	NO

Table 12 Analog DVRS Mode Features - P25 ASTRO Trunking Mobile

NOTE
Phase II features listed are preliminary.

The operation described below assumes a DVR Analog Mode channel and a Conventional Analog Channel are selected on the DVR and the XTL5000 respectively.

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on the O5	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	NO	NO	NO
Outbound Group Call	NO	NO	NO
Outbound Private Call	NO	NO	NO
Microphone PTT (MSU)	YES	Phase I NO – on DVR side YES – System side Phase II YES	Phase I NO – on DVR side YES – System side Phase II YES – DVR Side NO – System side
Inbound Group Call	NO	NO	NO
Inbound Private Call	NO	NO	NO
Inbound Call Alert	NO	NO	NO
Inbound Emergency Alarm / Call	NO	NO	NO
Call Alert / Steering	NO	NO	NO
Call Back	NO	NO	NO
Failsoft	NO	NO	NO
Out of Range	NO	NO	NO
Site Trunking	NO	NO	NO
Master / Slave Voting	NO	YES	YES
DVRS Status Tones – MSU Speaker	NO	YES	YES
DVRS Status Tones - PSU	NO	YES	YES
Radio Inhibit	NO	NO	NO
Radio Check	NO	NO	NO
Scan	YES	NO	NO
Talk Permit Tones	NO	YES	YES
OTAR	NO	NO	NO
Fire Ground	NO	NO	NO
Patch	NO	NO	NO
Dynamic Regrouping	NO	NO	NO
Phone	NO	NO	NO
Remote DVRS Activation / Deactivation	NO	NO	NO
Adaptive Power Control	NO	NO	NO
MDC1200 ID pass through	NO	NO	NO
Encryption	NO	NO	NO

Table 13 Analog DVRS Mode Features - Conventional Analog Mobile

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NOTE
Phase II features listed are preliminary.

The operation described below assumes a DVR Analog Mode channel and a Conventional Digital Channel are selected on the DVR and the XTL5000 respectively – **All Features listed below are planned for Phase II release and are subject to change.**

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on the O5	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	NO	NO	NO
Outbound Group Call	NO	**Phase II**	**Phase II**
Outbound Private Call	NO	NO	NO
Microphone PTT (MSU)	**Phase II**	**Phase II**	**Phase II** – DVR Side NO – System side
Inbound Group Call	NO	**Phase II**	**Phase II**
Inbound Private Call	NO	NO	NO
Inbound Call Alert	NO	NO	NO
Inbound Emergency Alarm / Call	**Phase II**	**Phase II**	**Phase II**
Call Alert / Steering	NO	NO	NO
Multiple Talk Groups	NO	NO	NO
Call Back	NO	NO	NO
Failsoft	NO	NO	NO
Out of Range	NO	NO	NO
Site Trunking	NO	NO	NO
Master / Slave Voting	NO	**Phase II**	**Phase II**
DVRS Status Tones – MSU Speaker	NO	**Phase II**	**Phase II**
DVRS Status Tones - PSU	NO	**Phase II**	**Phase II**
Radio Inhibit	NO	NO	NO
Radio Check	NO	NO	NO
Scan	**Phase II**	NO	NO
Talk Permit Tones	NO	**Phase II**	**Phase II**
OTAR	NO	NO	NO
Fire Ground	NO	NO	NO
Patch	NO	NO	NO
Dynamic Regrouping	NO	NO	NO
Phone	NO	NO	NO
Remote DVRS Activation / Deactivation	NO	NO	NO
Adaptive Power Control	NO	NO	NO
Emergency MDC1200 ID pass through	NO	NO	NO
Encryption	NO	NO	NO

Table 14 Analog DVRS Mode Features – P25 ASTRO Conventional Mobile

The operation described below assumes a DVR Analog Mode channel and a 3600 Analog or Digital Trunking mode are selected on the DVR and the XTL5000 respectively **All Features listed below are planned for Phase II release and are subject to change.**

FEATURE	DVR OFF Mode	DVR SYSTEM Mode	DVR LOCAL Mode
DVRS Status Display on the O5	VR OFF <DVR CH>	VR SYS <DVR CH>	VR LOC <DVR CH>
PSU Affiliation	NO	NO	NO
Outbound Group Call	NO	**Phase II**	**Phase II**
Outbound Private Call	NO	NO	NO
Microphone PTT (MSU)	**Phase II**	**Phase II**	**Phase II** – DVR Side NO – System side
Inbound Group Call	NO	**Phase II**	**Phase II**
Inbound Private Call	NO	NO	NO
Inbound Call Alert	NO	NO	NO
Inbound Emergency Alarm / Call	**Phase II**	**Phase II**	**Phase II**
Call Alert / Steering	NO	NO	NO
Multiple Talk Groups	NO	NO	NO
Call Back	NO	NO	NO
Failsoft	NO	NO	NO
Out of Range	NO	NO	NO
Site Trunking	NO	NO	NO
Master / Slave Voting	NO	**Phase II**	**Phase II**
DVRS Status Tones – MSU Speaker	NO	**Phase II**	**Phase II**
DVRS Status Tones - PSU	NO	**Phase II**	**Phase II**
Radio Inhibit	NO	NO	NO
Radio Check	NO	NO	NO
Scan	**Phase II**	NO	NO
Talk Permit Tones	NO	**Phase II**	**Phase II**
OTAR	NO	NO	NO
Fire Ground	NO	NO	NO
Patch	NO	NO	NO
Dynamic Regrouping	NO	NO	NO
Phone	NO	NO	NO
Remote DVRS Activation / Deactivation	NO	NO	NO
Adaptive Power Control	NO	NO	NO
Emergency MDC1200 ID pass through	**Phase II**	**Phase II**	**Phase II**
Encryption	NO	NO	NO

Table 15 Analog DVRS Mode Features - 3600 Analog / Digital Trunking Mobile

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	64
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	IP6 (water jet proof)
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-DVRS800	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 0.1W to 10W			
TCT Option	15 sec to 15 min or Disabled			
Max Spurious Output	-60dBc			
Frequency Stability	+/- 1.5ppm			
FM Hum and Noise 12.5 / 25 kHz	37 dB / 43 dB			
Audio Response	+1, -3 dB of 6 dB / octave pre-emphasis characteristic over 300 Hz – 3 kHz			
Audio Distortion	<2%			

Receiver Specification	VHF	UHF	700	800
Frequency Band [MHz]	136-174	380-430 450-470 470-512 380-403	794-806	806-825
Receiver Sensitivity	-115 dBm (0.32μV)			
Frequency Stability	+/- 1.5ppm			
Selectivity 12.5 / 25 kHz	60 dB / 75 dB			
Intermodulation	75 dB			
Deviation 12.5 / 25 kHz	+/-2.5 kHz / +/-5 kHz			
FM Hum and Noise 12.5 / 25 kHz	37 dB / 43 dB			
Audio Output (Repeater Detect Audio)	600 mV RMS nominal, flat response			
Audio Response	+1, -3 dB of 6 dB / octave pre-emphasis characteristic over 300 Hz – 3 kHz			
Audio Distortion	<2%			

Glossary

ACK	Acknowledgement of communications.
AVRA	Automated VR / DVR Activation. DVR Option which permits automated activation of the DVR, typically triggered by removing the portable from the charger (ON) and placing it back in (OFF).
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.
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 an XTL^{TM}5000 Mobile radio with O5 Control Head.
DVR ID	Programmable (in the DVR) ID, which is used for Mode / TG steering. To remotely change the Mode / TG on the DVRS, the PSU User sends a Call Alert Page to the specific DVR ID.
Extender	Variation of the SYSTEM DVR Mode, programmable per TG / DVR Channel. While in the Extender Mode the DVR repeats Local PSU-to-System and System-to-Local PSU communications but does not repeat locally i.e. no Local PSU-to-PSU communications are enabled.
FCC	Federal Communications Commission.
Inbound Call	PSU originated call 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.

Mobexcom II	Analog Vehicular Repeater, NOT compatible with XTL^{TM}5000 radios using CAN bus Control Heads such as the O5. Mobexcom II can be interfaced to XTL^{TM}5000 using W-series Control Heads, Astro Spectra or MCS2000 Mobile Radios.
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.
Outbound Call	System Call received by the MSU.
O5	Odyssey 5 Control Head using CAN bus.
Phase I	First DVR & XTL5000 Firmware Release – Release Date - Q1 2006.
Phase II	Second DVR & XTL5000 Firmware Release – Target Release Date – Q4 2006.
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.
Trunking	The automatic sharing of radio frequencies by large number of users based on communication path sharing for the length of a conversation.

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