Futurecom Systems Group, ULC

VRX1000 Installation Guide

Notes

Related Publications

Publication Number	Description
8A087X02	VRX1000 User's Guide
8A087X01	VRX1000 Ordering Guide
8K087X02	VRX1000 Functional Description

Manual Revisions

Rev #	Date	Notes & References
0	November 23, 2020	Original Release

Foreword

Futurecom Vehicular Repeater (**VR**) is designed to be seamlessly interfaced to:

- Remote Mount APX Series **MSU** with or without control head

When the VR is interfaced to a Remote Mount Motorola APX Mobile Radio, the complete equipment package is referred to as Digital Vehicular Repeater System (**DVRS**). APX Mobile Radios operating through a VR, utilizing the enhanced DVR digital feature set require option **GA00631**.

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

See https://futurecom.com/upl/downloads/resources/support-resources/firmware-compatibility-chart.pdf about version requirements for compatible Mobile and Portable radios.

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

For details on the DVRS Operation, please refer to the VR User's Guides **8A093X01**

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Trademarks

Commercial Warranty

Futurecom Systems Group, ULC. warrants to the original purchaser all standard products sold by Futurecom Systems Group, ULC to be free of defects in material and workmanship for one (1) year from the date of shipment from Futurecom Systems Group, ULC.

Futurecom's warranty hereunder DOES NOT cover the following:

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(ii) Defects or damage from improper installation, testing, operation, or maintenance.

(iii) Defects or damage due to alterations, modifications or adjustments carried out by the Buyer without Futurecom's explicit approval.

(iv) Defects or damage from misuse, accident, water or neglect.

(v) Freight costs to the repair depot.

(vi) Scratches or other cosmetic damage to the product surfaces that does not affect the operation of the product.

(vii) Normal wear and tear.

The warranty set forth herein is conditioned upon proper storage, installation, use and maintenance in accordance with applicable written recommendation of Futurecom. The warranty furnished hereunder does not extend to damage to items purchased hereunder resulting in whole or in part from the use of components, accessories, parts of supplies not furnished by Futurecom Systems Group, ULC.

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

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

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

If Extended Warranty is required, it must be purchased either at the time of original purchase or while the unit is under the standard first year warranty coverage.

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Notations Used in This Manual

The following notations are used throughout this document:

NOTE:
A clarifying statement that expands on the text that follows.

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

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

Declaration of Conformity

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

FCC LABELS:

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

(1) This device may not cause harmful

interference. and

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

FCC SECTION 15.105 INFORMATION TO THE USER:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.

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

ATTENTION!
Changes or modifications not expressly approved by Futurecom Systems Group, ULC. could void the User's authority to operate the equipment. To satisfy FCC/IC RF exposure requirements for mobile transmitting devices, the minimum separation distances specified in Table 1 should be maintained. To ensure compliance, operations at closer than this distance is not allowed.

ATTENTION!
Futurecom requires the P25 VRX1000 operator to ensure FCC Requirements for Radio Frequency Exposure are met. The minimum distance between all possible personnel and the body of the VRX1000 equipped vehicle is specified in the "RF Safety" booklet. 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.

USA Users: Do not use the VRX1000 in the frequency band 406.0 – 406.1MHz. This frequency band is reserved for distress beacons.

ATTENTION!
This radio 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.

It is the responsibility of the VRX1000 Operator to ensure that Maximum Permissible Exposure (MPE) limits are always observed during repeater transmissions. If this vehicular repeater is used in combination with a separate mobile radio transmitter, the Repeater operator must ensure at all times that no person comes within the MPE distance from the vehicle body to ensure compliance with the FCC's/IC's RF energy exposure limits for the general population.

The minimum lateral distance between all possible personnel and the body of the VRX1000 equipped vehicle must be as specified in Table 1.

Failure to observe the 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).

VRX1000 (3W)	Minimum Lateral Distance from Antenna
VHF	67.0cm (26.4 inches) (up to 100% Tx duty cycle)
UHF 380-512MHz	40.0cm (15.75 inches) (up to 100% Tx duty cycle)
700MHz	28.3cm (11.1 inches) (up to 100% Tx duty cycle)
800MHz	26.8cm (10.6 inches) (up to 100% Tx duty cycle)

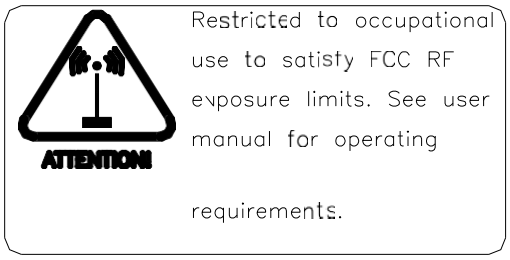
Table 1 Minimum Lateral Distance from Antenna – VRX1000

50% Tx duty cycle is defined as Push To Talk (PTT), 50% Talk - 50% Listen. 100% Tx duty cycle is defined as Push To Talk (PTT), 100% Talk

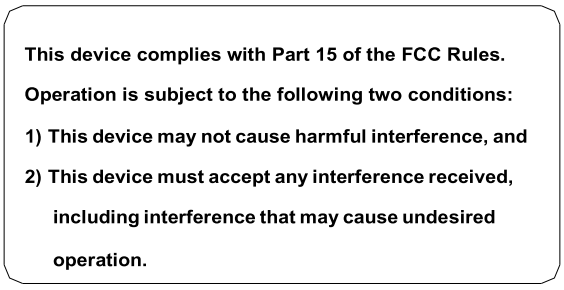
IMPORTANT!

The nominal allowed gain of the λ/4 Omni-directional antenna for the VRX1000 is Unity (0 dBd).

RF Exposure Label



The RF Exposure Label should be affixed in the vehicle beside the mobile radio control head. The label should be in the direct view of the Repeater operator. The label is supplied with the VRX1000.



FCC Label

Installation Requirements for Compliance with Radio Frequency (RF) Energy Exposure Safety Standards

ATTENTION!

To ensure compliance with RF Energy Safety Standards:

- Install only Futurecom / Motorola Solutions approved antennas and accessories and set conducted power into the VRX1000 antenna equal to or lower than the approved power levels – refer to **Table 1.**

Introduction

The VRX1000 is a simplex radio coverage extender, which is interfaced to a compatible remote mount Motorola Solutions Mobile Radio and enables Portable Subscriber Units (PSU) to be used in areas where only Mobile Subscriber Unit (MSU) coverage is available and PSU coverage is either intermittent or completely absent.
Installed in the trunk of a car, fire truck, armored vehicle, ambulance, the VRX1000 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 VRX1000 extends voice (analog or digital, clear or encrypted) communications and supports key Trunking system features. The VRX1000 can be configured to provide various advanced options to the users.

The Vehicular Radio Extender (**VRX1000**) is designed to be seamlessly interfaced to the following Motorola Solutions Mobile Radios:

Mobile Radio Model	Firmware Requirements	Notes
APX4500	R21.40.00	Requires option **GA00631**
APX6500	R21.40.00	
APX7500	R21.40.00	
APX8500	R21.40.00	
NOTE: Mobile Radio must be configured as Remote Mount in order to be compatible with the VRX1000.		

Table 2 below provides information on the VRX1000 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/FA	**NO**	**YES** D/M/FA	**NO**
P25 Conventional 'DVRS Enabled'	**YES** FA/FA-All	**YES** D/FA/FA-All/M	**YES** FA/FA-All	**YES** D/FA/FA-All/M	**YES** D/FA/FA-All/M

Table 2 VRX1000 vs Infrastructure Compatibility (Voice and Signaling)

VRX1000 Channel Types:
A = Analog, D = Digital, M = Mixed, FA = Forced Analog, FA-All=Forced Analog All (See Part II of this manual)

Identifying Your VRX1000 Model

Frequency Band of Operation

Depending on the frequency band of operation of the APX Mobile Subscriber Unit (MSU) and VRX1000, the VRX1000 models are classified as follows:

- **In-Band** – when the MSU and VRX1000 operate in the same frequency band.
- **Cross-Band** – when the MSU and VRX1000 operate in two different frequency bands.

Cross-Band

Cross-Band VRX1000 models do not include any filters on the MSU side since the MSU and VRX1000 are not intended to simultaneously operate in the same frequency band. In single band MSU configurations the MSU and VRX1000 operate in different frequency bands.
In dual band MSU configuration either the MSU & VRX1000 operate in 3 different frequency bands or one of the MSU frequency bands is locked out when VRX1000 operation is enabled as shown on **Figure 1**.

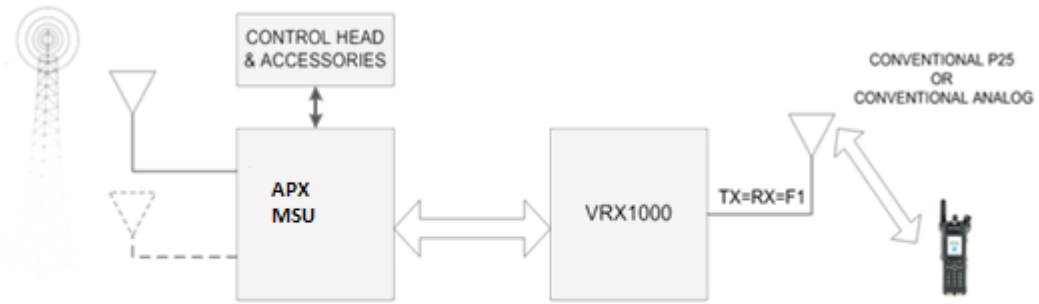
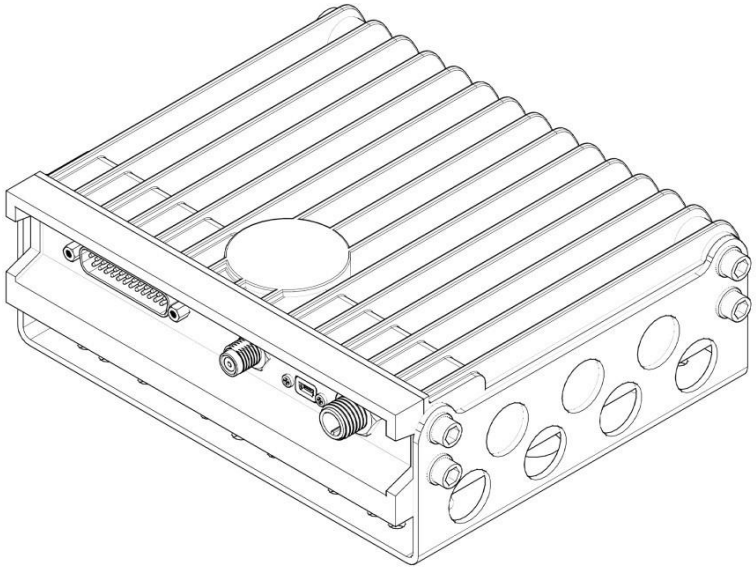


Figure 1 Cross-Band VRX1000 - Conceptual Diagram

Cross Band VRX1000 Dimensions



180 [7.10] x 160 [6.30] x 63 [2.48] mm [in]

Figure 2 Cross-Band VRX1000 - Dimensions mm / [in]

In-Band

The in-band VRX1000 models are equipped with two sets of filters, which are required in order to ensure interference-free operation when both the MSU and VRX1000 are transmitting and receiving simultaneously in the same frequency band. The VRX1000 filter provides 40 dB isolation on the Mobile radio transmit / receive frequencies. The filter installed at the output of the MSU is designed to provide 40dB isolation on the VRX1000 TX/RX Frequency Range.

IMPORTANT!

The above filter isolation must be complemented by 30dB minimum antenna isolation (between the VRX1000 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 VRX1000 antenna is mounted on the trunk. Each VRX1000 is shipped equipped with custom filters tuned to the specified frequency bands – note the frequency range specified on the filter labels. Programming the VRX1000 / 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.

NOTE:

The VRX1000 and MSU require two or three (in the case of dual band MSU) separate antennas.

NOTE:

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

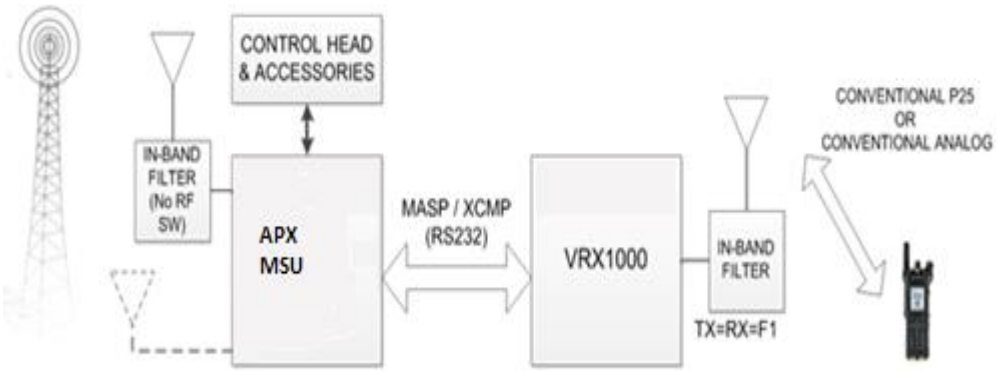


Figure 3 In-Band VRX1000 - Conceptual Diagram

In-Band VRX1000 Dimensions

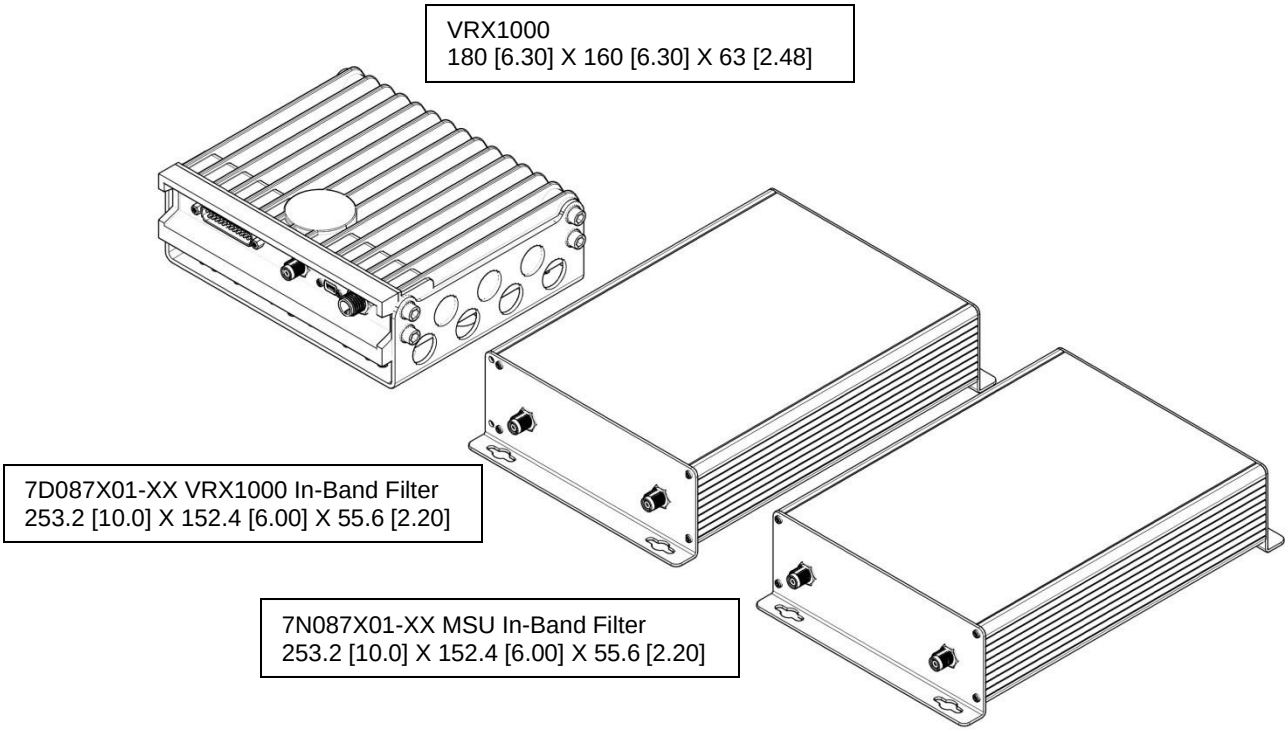


Figure 4 In-Band VRX1000 – Flat Mount Dimensions mm / [in]

NOTE:
The in-band filters are also available as stacked mount.

VRX1000 Installation Basics

Planning the Installation

Before starting the installation, inspect the vehicle and determine how and where you intend to mount the antennas (one or two connected to the Mobile Radio and one to the VRX1000), the VRX1000 components, MSU, Control Head, MSU accessories. Ensure to provide adequate separation between the Mobile Radio and VRX1000 antennas.

When planning the VRX1000 installation, make sure to leave adequate room around all modules to allow for easy RF and Control cabling connections and to enable programming / re-flashing access to both the VRX1000 and MSU ports.

Ensure all VRX1000 components are mounted within the interconnecting cables range.

The VRX1000 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.
Futurecom recommends installation of voltage surge protection to protect the car electronics to prevent spikes in the supply voltage

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.
Hex Key 4mm	Securing VRX1000 to the mounting bracket.
Wire Cutters and Crimping Tool	DC power cable installation.
3.16" Flat Torque Screwdriver set to 5lbf.in [0.56Nm]	Tightening of connector screws.

Mounting the VRX1000

Cross-Band VRX1000 Mounting

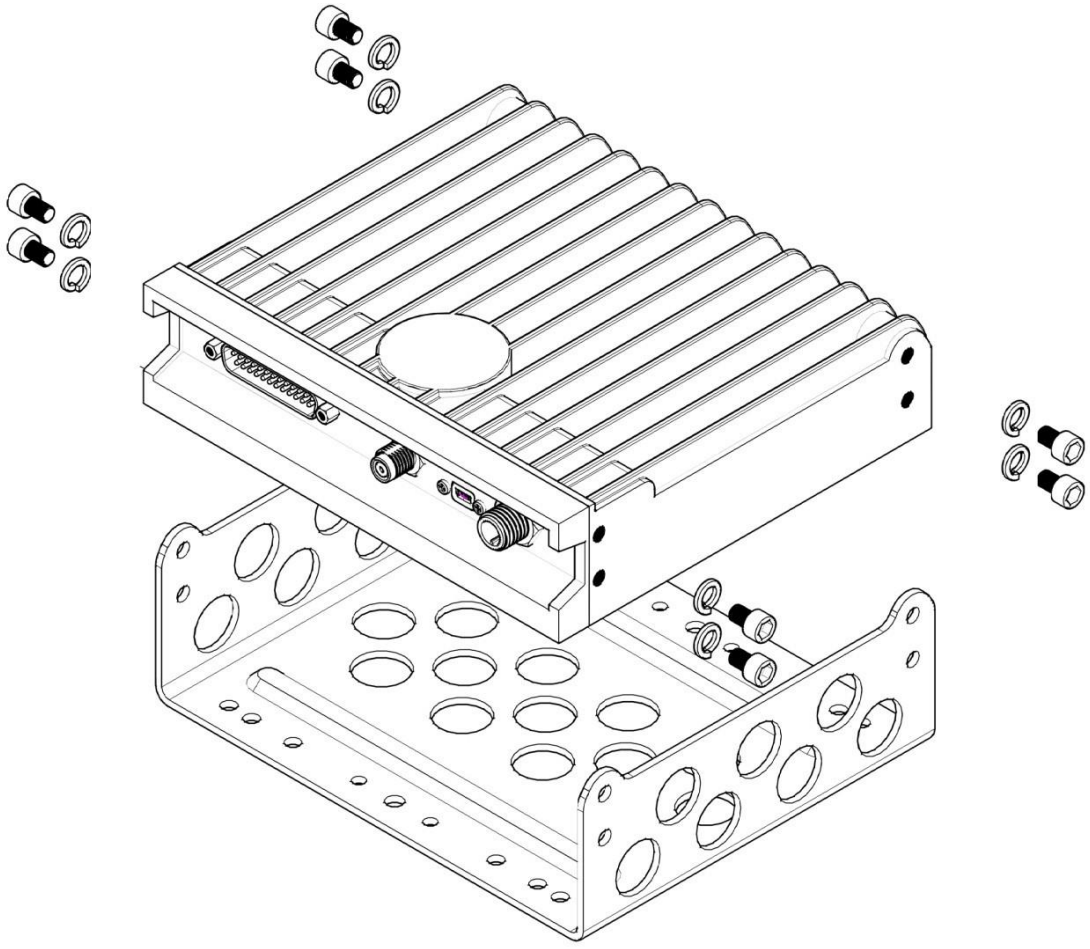


Figure 5 Cross-Band VRX1000 Mounting Details

In-Band VRX1000 Mounting

The in-band VRX1000 Configuration requires two filters to be installed in line with the VRX1000 and APX MSU Antennas respectively in order to prevent desense when one of the radios is receiving and the other transmitting.

The in-band filters are to be mounted as close as possible to the corresponding radios in order to minimize the insertion losses. A set of two 20” long RF cables (mini UHF connectors) is provided with the in-band option for connecting the in-band filters to the MSU and VRX1000.

The filtering enclosure has a built in mounting arrangement.

Figure 6 In-Band VRX1000 - Flat Mount Details

Figure 7 In-Band VRX1000 Stacked Mount Details

Mounting the Mobile Radio

For detailed Mobile Radio and accessories Installation Instructions, please refer to the Installation Manuals available from Motorola Solutions. Ensure the Remote Mount MSU is mounted beside the VRX1000 within the range of the VRX1000 cabling.

NOTE:
Unless special cabling length is specified upon placing an order, the VRX1000 is shipped with a standard 3ft-long interconnect cable between the MSU and VRX1000.

Connecting the VRX1000 Cables

NOTE:
The VRX1000 antenna port connector (cross-band and in-band models) is a mini UHF female.

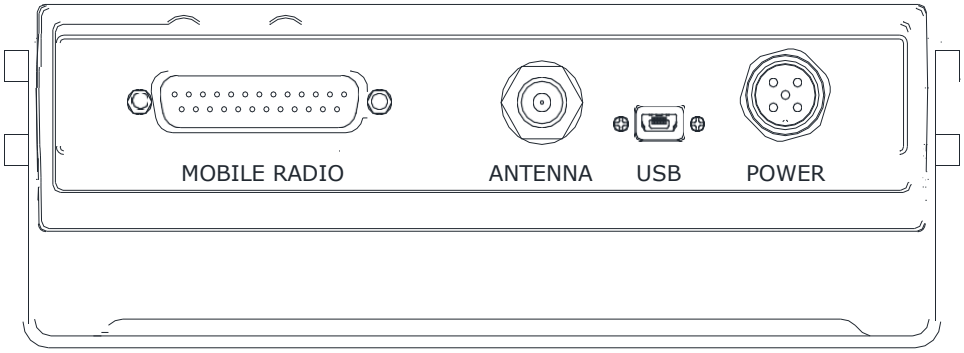


Figure 8 VRX1000 Connectors

IMPORTANT!
The VRX1000 operates only in negative ground, +12VDC electrical systems. Before starting the installation, make sure that the ground polarity of the vehicle is correct.

Power Cable

ORDER CODE	Description	Type / Length
DDN1966A (FC PN 7W087X20-01)	• DC Power Cable • Included with the VRX1000 • Can be ordered as spare	M12 Circular connector 18 feet

The VRX1000 Power Cable installation guidelines are listed below:

1. Determine power cable routing between the VRX1000 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 VRX1000 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

QTY 2 of the following RF cable are provided with the In-Band VRX1000 Models:

FEMALE CONNECTOR

ORDER CODE / PN	Description	Connector Type / Cable Length
DDN1967A **(FC PN 7W087X11-XX)**	• RF Cable for In-Band filter kit • Connects MSU or VRX1000 to In-Band Filter • QTY 2 cables are included with all In-Band VRX1000 Models • Can be ordered as spare	Mini UHF (m) connectors; Length 2 ft. Custom Lengths available on request
PN 7W900X93-01	• RF Cable between the APX8500 and the notch filter,	QMA/Mini UHF

Table 3 VRX1000 RF Cables

Control Cables

The following Control Cable types are available:

ORDER CODE	Description	Length
DDN1968A	**Programming Cable** • USB to mini USB Connectors • Ordered separately (not included with the VRX1000)	10 feet
DDN1969A (FC PN 7W087X07-XX)	**Standard Control Cable** • DB25 to DB25 • Connects the VRX1000 to the MSU **included with the VRX1000.** Can be ordered as spare.	3 feet standard length Up to 25ft available upon request
TT05964AA (FC PN 7W087X08-XX)	**Y - Control Cable / AUX** • DB25 to DB25 & DB15 • Connects the VRX1000 to the MSU and provides access to the VRX1000 AUX pins (DB15) • can be ordered as an option • replaces the Standard Control Cable	3 feet standard length Up to 25ft available upon request

Table 4 VRX1000 Control Cable Types

DB25 MALE CONNECTOR

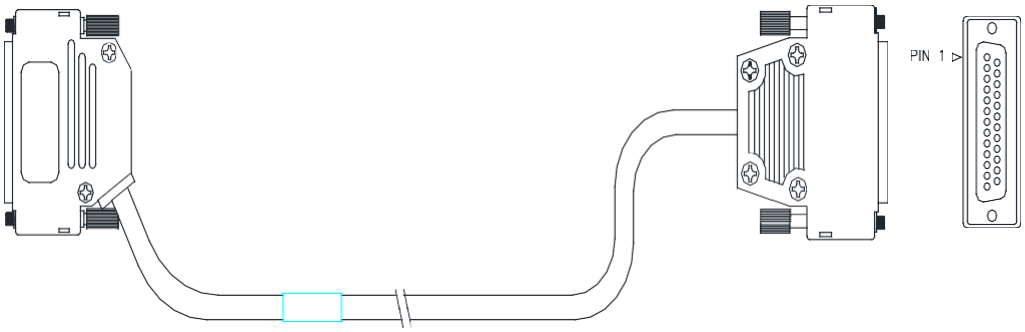


Figure 9 VRX1000 Standard Control Cable (PN 7W087X07)

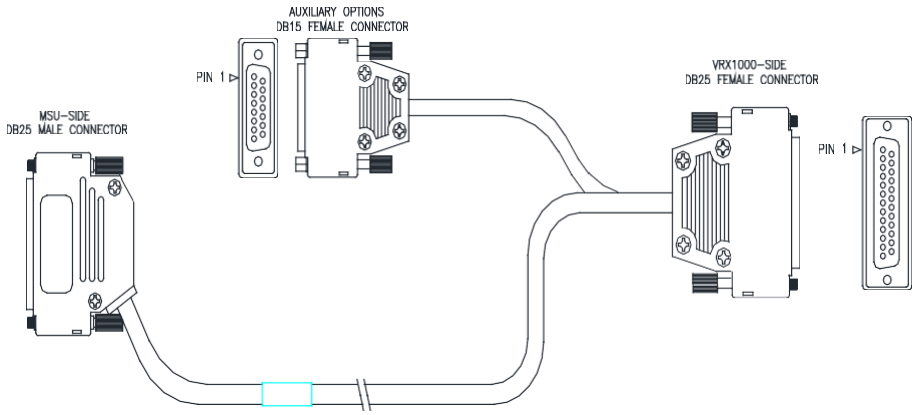


Figure 10 VRX1000 Y-Control Cable with AUX Extension (PN 7W087X08)

Tighten VRX1000 Control Cable DB25 connector thumb screws using 3/16” flat torque screwdriver set to 5lbf.in [0.56Nm].

ATTENTION!

Using excessive torque while tightening Control Cable DB25 connector thumb screws can permanently damage VRX1000 DB25 connector!

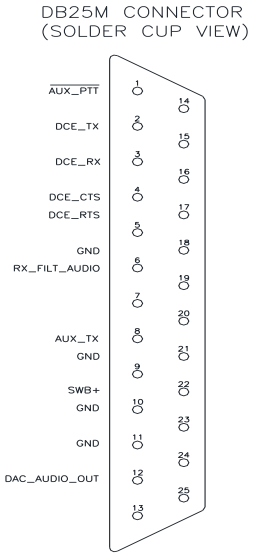
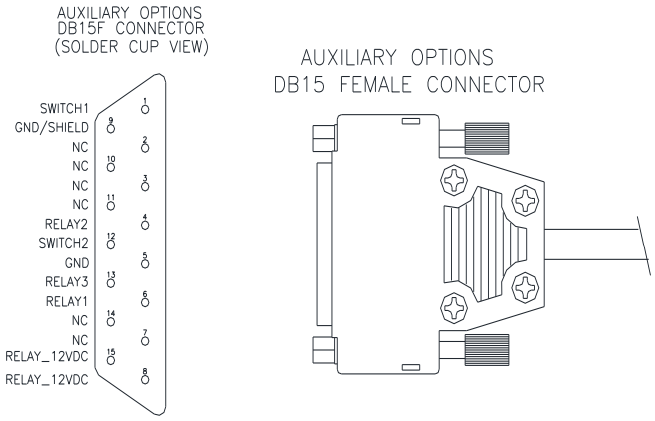


Figure 11 MSU Side DB25 Pinout (All Control Cables)

VRX1000 Auxiliary Cable

The VRX1000 Auxiliary port provides three relay driver output ports and two switch contact input ports, which can be interfaced to external logic. The VRX1000 Auxiliary port is provided on the Y-Control Cable **7W087X08**. The external logic can be easily interfaced by connecting to the correct pins on the DB15 connector as described in the next paragraph.

The DB15 pinout is shown below.



Pin #	Designation	*Note*
1	SWITCH 1	*Alternative AVRA Input, operating as programmed in the Futurecom Repeater Configurator's Hardware Setup Screen*
2	NC	NOT USED
3	NC	NOT USED
4	RELAY 2	*Primary Light Output / as programmed*
5	GND	*Ground*
6	RELAY 1	*RF Switch Output / as programmed*
7	NC	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*
NC	NOT USED	NOT USED
11	NC	NOT USED
12	SWITCH 2	*For future use*
13	RELAY 3	*As programmed*
14	NC	NOT USED
15	*RELAY_12VDC*	*12VDC for powering up relay coil. Max current draw is 750mA TOTAL from both pins 8 & 15.*

Figure 12 Auxiliary Options - DB15 Pinout

AVRA

The Automated VR Activation (AVRA) option enables automated VRX1000 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 VRX1000 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 Solutions for detailed instructions.

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

'Switch 1 Input' on the DB15 of the VRX1000 Auxiliary Cable (PN 7W087X08 or 7W087X10).

- The 'Automatic VR Activation' selection box in the VRX1000 Hardware Setup Menu must be checked.
- The 'AVRA Uses VIP on CH' selection box in the VRX1000 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 VRX1000 can be programmed to provide several status indications – 'Master Light', 'LOC Mode Light', 'SYS Mode Light' or 'VRX1000 ON Light'.
The VRX1000 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 VRX1000.
The Light Switch Relay Coil "+" must be wired to +12V DC and the "-" to the corresponding Relay Output on the DB15 connector of the VRX1000 Auxiliary cable (500mA Max).

External Alarm

In applications where the VRX1000 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 'over temperature' combined alarms.

VRX1000 Antenna Installation

Any VRX1000 configuration requires the use of two or three antennas – one or two connected to the MSU and one connected to the VRX1000. For a list of approved VRX1000 antennas, please refer to **Appendix 7.**

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 consider the potential exposure of back seat passengers and bystanders outside the vehicle.

The MSU and VRX1000 antennas must be installed in such way as not to cause interference.

IMPORTANT!
All VRX1000 models require 30dB minimum Antenna Isolation between the VRX1000 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 **Table 1.**
- Ensure the trunk lid is grounded by connecting grounding straps between the trunk lid and the vehicle chassis.

NOTE:
The VRX1000 antenna ports are mini UHF female and require antenna cables with matching mini UHF male terminations.

Appendix 1– VRX1000 Specifications

General Specifications			
Dimensions: Height / Width / Depth	45mm x 175mm x 160mm (cross band, no filters)		
Weight	2kg / 4.4 lbs (cross band, no filters)		
Channel Spacing	12.5 or 25 kHz programmable		
Number of Channels	192		
Number of MSU Modes (VRX1000 Enabled)	2047 Entries		
CTCSS/DCS	Programmable per Analog Channel		
Power Supply	13.8V DC +/- 20%, negative ground only		
DC Current Drain (VRX1000 Only):			
VRX1000 Off	0.01 A Max		
VRX1000 Standby	0.8 A		
VRX1000 Receive	0.8 A		
Transmit	3.0 A		
Operating Temperature	-30ºC to +60ºC		
Storage Temperature	-40°C to +85°C		
Protection Against Liquids	IP54		
Antenna Impedance	50 Ohms		
Duty Cycle	50% Receive / 50% Transmit		
External Connectors:			
Antenna	Mini UHF		
Computer Interface	Mini USB		
Mobile Radio	DB25		
Auxiliary / Options	DB15 (Y cable)		
DC Power	M12 Circular		
Equipment Type Acceptance	**VHF**	**UHF**	**700 / 800**
FCC	LO6-VRX1000VHF	LO6-VRX1000UHF	LO6-VRX1000700800
Industry Canada	2098B-VRX1000VHF	2098B-VRX1000UHF	2098B-VRX10007800
Transmitter Specification	**VHF**	**UHF**	**700 / 800**
Frequency Band FCC [MHz]	136-174	380-406	764-775
		406.1-512	851-869
Frequency Band IC [MHz]	138-174	406.1-430	768-776
		450-470	851-869
Power Output @ Antenna Port	Programmable 0.5 – 3 Watts		
TCT Option	15 sec to 15 min or Disabled		
Max Spurious Output	-20 dBm		
Frequency Stability	+/- 0.75ppm		
(-30°C to +60°C; +25°C Ref.)			
FM Hum and Noise 12.5 / 25 kHz	34 dB / 40 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 FCC [MHz]		136-174	380-406	764-775
			406.1-512	851-869
Frequency Band IC [MHz]		138-174	406.1-430	768-776
			450-470	851-869
Receiver Sensitivity				
Analog 12 dB SINAD			-115 dBm	
Digital P25 5% BER			-115 dBm	
Frequency Stability		+/- 0.75ppm		
(-30°C to +60°C; +25°C Ref.)				
Selectivity	12.5 / 25 kHz	60 dB / 70 dB		
Intermodulation		70 dB		
Spurious Rejection		70 dB		
Analog Mode Deviation	12.5 / 25 kHz	+/-2.5 kHz / +/-5 kHz		
Frequency Deviation for C4FM (P25)				
	Low Level		841 – 1037 Hz	
	High Level		2543 – 3110 Hz	
Analog Mode FM Hum and Noise 12.5 /		34 dB / 40 dB		
	25 kHz			
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%		
Military Standards Compliance			**MIL-STD-810G**	
High Temperature			501.6 I – A1	
			501.6 II	
Low Temperature			502.6 I – C3	
			502.6 II	
Temperature Shock		503.6 – C Procedure I		
Rain		506.6 III		
Humidity		507.6 Procedure II (Aggravated)		
Salt Fog		509.6		
Vibration		514.7 – I category 24		
Mechanical Shock			516.7 Procedure I (Function)	
		516.7 Procedure VI (Bench Handling)		

Appendix 2 – Accessories

VRX1000 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)

Spare Cables

Order Code	PN	Length	Notes
DDN1966A	**7W087X20-01**	18ft	VRX1000 DC Power Cable
DDN1966A	**7W087X11-01**	2ft	RF Cable for in-band filter kit
DDN1968A	NA	10ft	VRX1000 Programming cable (USB)
DDN1969A	**7W087X07-01**	3ft	VRX1000 Control Cable
DDN1970A	**7W087X08-01**	3ft	VRX1000 Y-Control Cable with AUX option

Contact Information

Technical Support

905-532-1158
support@futurecom.com

Orders

Please contact Motorola Solutions / Drop Ship

Return Authorizations

1-800-701-9180

Head Office and Manufacturing

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

www.futurecom.com

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Glossary

Keyword	Description
ACK	Acknowledgement of communications.
AVRA	Automated DVR/VRX Activation. Permits automated activation of the DVR/VRX1000 by either using a VIP input on the MSU CH / DEK or a pin on the DVR/VRX1000 Auxiliary cable. Requires external logic / switch, not supplied with the DVRS/VRX1000 Hardware.
Authentication	To prevent unauthorized access for Conventional DVRS PSU, Authentication key can be loaded on the authentication capable DVRS PSU.
Band Lock	When enabled, causes the MSU to block usage of the same frequency band as the DVR/VRX1000 while the DVR/VRX1000 is active. Enabled when no in-band filter is present.
BL	Busy Lockout – dynamic voting phase (follows the static Primary / Secondary phase) of the DVR/VRX1000 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/VRX1000 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	When a Vehicular Repeater (VR) is interfaced with an MSU, the complete equipment package is referred to as a Digital Vehicular Repeater System (DVRS).
'DVRS/VRX1000 Enabled' PSU	P25 XTS™1500, XTS™2500, XTS™5000, APX™4000, APX™6000 or APX™7000 Portable Radio with enabled DVRS/VRX1000 operation.

Keyword	Description
EPR File	File containing DVR/VRX1000 personality (dpd) and calibration data of the specific DVR/VRX1000 unit. Typically saved in the following format xxxxxxxx.epr where xxxxxxxx is the SN of the specific DVR/VRX1000.
FCC	Federal Communications Commission.
FNE	Fixed Network Equipment – Trunking or Conventional System Infrastructure
Forced Analog Mode	Hybrid DVR/VRX1000 Mode of operation where communications between the DVR/VRX1000 and the P25 'DVRS/VRX1000 enabled' PSUs are digital while the voice communications are forced to be analog when the MSU is operating on a non-P25 channel / TG. When the MSU is operating on a P25 channel / TG, the DVR/VRX1000 is operating in Digital mode (digital voice and signaling).
FRC	Futurecom Repeater Configurator
Heart Beat	P25 Message periodically sent by a Primary DVR/VRX1000 to other DVR/VRX1000 units 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/VRX1000.
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. Since the VRX1000 is simplex only, there is no Local repeat in 'Local Mode'.
Local PSU	PSU switched to the DVR/VRX1000 channel and used for communication with the DVR/VRX1000
Local Tx Fallback	When enabled, the MSU reverts to local call if the MSU fails to access the system.

Keyword	Description
Mode	**MSU / PSU** - A programmed combination of operating parameters. **DVR/VRX1000** – OFF, SYSTEM or LOCAL
MPE	Maximum Permissible Exposure.
MSU	Mobile Subscriber Unit
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/VRX1000 Steering.
NID	Network ID - see Network Access Code (NAC)
Outbound Call	System Call received by the MSU.
PSU	Portable Subscriber Unit.
PSU Scan	This feature allows a scan list to be attached to PSU that is configured with DVRS as its system type. This enables an Enhanced PSU to support conventional scan feature.
PTT	Push to talk. The PTT engages the transmitter (of the Portable or Mobile radio or VRX1000) when pressed.
RF	Radio Frequency. Part of the general frequency spectrum 10kHz - 10,000,000 MHz.
RSSI	Received Signal Strength Indicator.
System Mode	DVR/VRX1000 mode which provides extended voice and signaling communications between System Users and Local Portable Users over the selected DVR/VRX1000 channel / MSU 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.
Futurecom Repeater Configurator	Vehicular Repeaters (VR) Programming Software Application
VR	Futurecom line of Vehicular Repeaters. It applies to one of the following products: VRX1000, DVR and DVR-LX.

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