VRX1000

VEHICLE RADIO EXTENDER

User's Guide

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NOTES

Contents

Manual Revisions

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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 in order to achieve adequate equipment operation.

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

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 are 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 observed at all times during repeater transmissions. If this vehicle 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

NOTE:

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.

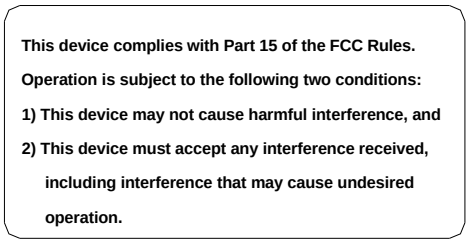
IMPORTANT

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

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 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 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.

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.

VRX1000 Operation Basics

The operation of the VRX1000 is determined by the following:

- Firmware, Tier Options and programming settings of the VRX1000 (VRX1000 personality).
- Firmware options and programming settings of the MSU that is interfaced to the VRX1000.
- Configuration capabilities and programmed settings of the radio system.
- Type and programming settings of the portable radios used for communications through the VRX1000.

IMPORTANT!
Depending on the selected personality settings and configuration capabilities of the complete radio system infrastructure, the features / options described throughout this document may or may not be applicable to the specific VRX1000 operation.

Powering up the VRX1000

The VRX1000 powers up together with the MSU. The power up mode and channel are programmable. Depending on the programmed personality, the VRX1000 can power up in one of the following states:

- VRX1000 Disabled mode, last selected VRX1000 channel
- OFF mode
- SYSTEM mode, last selected VRX1000 channel
- SYSTEM mode, preprogrammed VRX1000 channel
- LOCAL mode, last selected VRX1000 channel
- LOCAL mode, preprogrammed VRX1000 channel
- If the VRX1000 powers up on a 'strapped' mobile radio channel, the VRX1000 will be steered according to the Talk Group selected on the MSU. The steering may involve both VRX1000 channel and mode change.

Turning ON the VRX1000

When the MSU is powered up, the VRX1000 can be activated by one or more of the methods described in the following section.

- The VRX1000 is ON when SYSTEM (or optionally LOCAL) mode of operation is selected.
- The VRX1000 is OFF when OFF mode is selected.
- The VRX1000 is disabled when a "VRX1000 Disabled" Mode / Channel is selected on the APX MSU or if the currently selected VRX1000 and MSU modes are incompatible (such as TDMA MSU mode and P25 Digital VRX1000 channel).

NOTE:
The VRX1000 can only be activated when a compatible "VRX1000 Enabled" mode / channel is selected on the APX MSU.

Activating the VRX1000 via the Control Head

Ensure the MSU is powered up and a VRX1000 Enabled TG / channel is selected on the control head.
To activate the VRX1000:

- Press the **DVRS** menu item to enter the 'DVR/VRX1000 Control Mode'.
- Once in the 'DVR/VRX1000 Control Mode' screen, press the **MODE** button to toggle the available VRX1000 modes until the desired mode is selected.
- Press the **SEL** button or wait the preprogrammed time until the 'DVR/VRX1000 control Mode' screen times out. The last selected VRX1000 mode becomes effective.
- Long press of the **DVRS** menu item can be programmed to turn the VRX1000 ON/OFF.

Pressing the **DVRS** button allows the user to enter the 'DVR / VRX1000 Control Mode' and to select the desired VRX1000 mode and channel.

Turning OFF the VRX1000

Deactivating the VRX1000 via the MSU Control Head

To deactivate the VRX1000 via the MSU control head:

- Press the **DVRS** button to enter the 'DVR/ VRX1000 Control Mode', then press the **MODE** button until **VR OFF** is displayed and either press the **SEL** button or wait for the screen timeout (6 seconds).
  OR
- Select a 'DVR Disabled' TG / Mode / Zone on the MSU
  OR
- Power down the MSU if radio operation is no longer required.

Selecting VRX1000 Channel

When a 'DVRS Enabled' TG / Channel is selected on the MSU, the user may enter the 'DVRS/VRX Control Mode' by pressing the assigned DVRS button on the MSU control head and then change the VRX1000 mode / channel / status as described below:

Independent VRX1000 Channel Change

To change the VRX1000 channel:

- Press the **DVRS** button and observe the display changing to the 'DVR/VRX Control Mode' screen with the top line displaying the currently selected VRX1000 mode and channel.
- Use the MSU control head navigation keys to scroll through the available VRX1000 channels. Once the desired VRX1000 channel is selected, press the **SEL** button or wait until the control mode times out.

Strapped VRX1000 Channel Change

The VRX1000 mode and channel may be programmed to be strapped to the specific MSU TG/channel. In this case, selecting a specific MSU TG / channel would automatically force the VRX1000 to revert to a given VRX1000 channel and/or mode.
For example, selecting a VRX1000 *Enabled TG named 'DISPATCH' on the MSU CH may automatically force the* VRX1000 *to switch to Channel 1, SYSTEM Mode.*
When strapping is enabled, and the VRX1000 channel follows the MSU TG/mode selection, the user may still be allowed (if enabled by the VRX1000 programmed personality) to change the VRX1000 channel by pressing the **DVRS** button and then turning the mode knob.

Local Mode Indication

When the VRX1000 is operating in the LOCAL mode, the "DVRS/VRX Enabled" PSU User can see "**LOCAL ONLY**" message displayed on the PSU screen if Status broadcast is enabled in the VRX1000 as described in the 'Status Broadcast' paragraph. The above indication is only available on 'DVRS/VRX Enabled' P25 PSUs.

Appendix 1 – VRX1000 Specifications - Preliminary

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 (VRX 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 VRX1000 Standby VRX1000 Receive Transmit	 0.01 A Max 0.8 A 0.8 A 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 (programming only) Single ended input voltage 0.3V - 2.8V, 12Mbps max., 1 MOhm input impedance, 31 - 42.1 Ohm output impedance		
Mobile Radio	DB25 RS232: 115 kbps max., +/-3V min. input, 5 kOhm input impedance, 300 Ohm output impedance Analogue audio ports: 200 kOhm input impedance, 15 Ohm output impedance		
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	380-406 406.1-512	764-775 851-869
Frequency Band IC [MHz]	138-174	406.1-430 450-470	768-776 851-869
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 (-30°C to +60°C; +25°C Ref.)	**+/- 0.75ppm**
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	380-406 406.1-512	764-775 851-869
Frequency Band IC [MHz]	138-174	406.1-430 450-470	768-776 851-869
Receiver Sensitivity **Analog 12 dB SINAD** **Digital P25 5% BER**		**-115 dBm** **-115 dBm**	
Frequency Stability (-30°C to +60°C; +25°C Ref.)		**+/- 0.75ppm**	
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** **High Level**		 **841 – 1037 Hz** **2543 – 3110 Hz**	
Analog Mode FM Hum and Noise 12.5 / 25 kHz		**34 dB / 40 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%**	
Military Standards Compliance		**MIL-STD-810G**	
High Temperature		**501.5**	
Low Temperature		**502.5**	
Temperature Shock		**503.5**	
Rain		**506.5**	
Humidity		**507.5**	
Salt Fog		**509.5**	
Vibration		**514.6**	
Mechanical Shock		**516.6**	

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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