Futurecom Systems Group, ULC

Application Note:
End-to-End Digital Encryption on TDMA P25 Phase 2

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End to End Digital Encrypted Voice calls on TDMA (P25 PH2) System using Futurecom's Digital Vehicular Repeater System or VRX1000 Vehicle Radio Extender **DVRS/VRX1000** Solution.

Introduction

Futurecom Systems Group **DVR/VRX1000** is used in many P25 Trunked Radio Networks as a Network/Range extender. Combined with an APX Mobile Subscriber Unit (MSU) to make a **DVRS/VRX1000**, the **DVRS/VRX1000** provides extended coverage to APX Portable Subscriber Units (PSUs).

Recently, on P25 Phase 2 networks end to end digital operation through any P25 mobile repeater was not possible due to the difference between the Phase 1 and Phase 2 vocoders. This changed with the release of APX R15 MSU/PSU firmware and the matching DVRS R1.3. The extensive list of features including end to end encryption is now available whether extending FDMA or TDMA talkgroups.
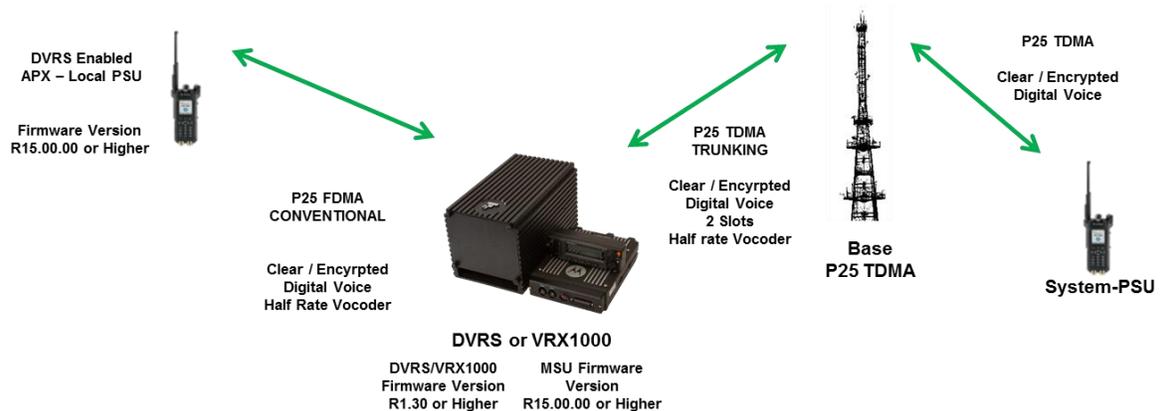
DVRS

VRX1000

Figure 1: General Overview

The channel between local PSU (L-PSU) and DVRS is conventional P25, 12.5 kHz FDMA using the full rate vocoder. If the link between the MSU and network is also FDMA (full rate vocoder), passing the digital audio packets between portable and network through the DVRS is relatively straightforward. However if the talkgroup is TDMA a half rate vocoder is used making this task much more complex.

In networks, the patching of TDMA and FDMA talkgroups is achieved with a transcoding server in the network core. This device decodes the digital audio, changes it from one

format to the other, and then encrypts it again. All in close to real time. This is virtually impossible to achieve in a mobile environment so another solution is required.
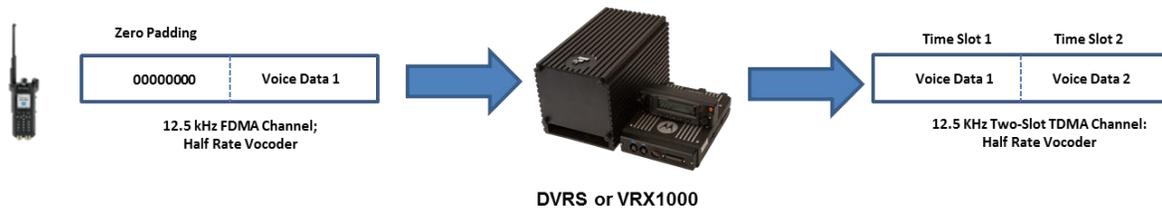

Figure 2: Full Rate to Half Rate Conversion

The option selected was to use the Phase 2 half rate vocoder on the L-PSU to DVRS link 12.5 kHz FDMA link. This allows the digital audio packets to pass transparently through the DVRS and requires no new hardware. The outgoing packets are padded to maintain the correct size on the FDMA channel. This padding is removed upon reception by the DVRS before being passed to the mobile which then puts this audio into one of the two TDMA slots. In the other direction, the mobile passes a half rate encoded audio packet to the DVRS which pads it prior to sending out on the FDMA channel.   The portable in turn receives this packet, removes the padding and then forwards it to the vocoder which decodes it and presents the audio in the portable speaker.

APX firmware of R15 or greater is required in the MSU and PSU while the DVRS needs 1.30 or newer. Additionally the APX portable must be DVRS enabled with QA00631 DVRS PSU operation and be TDMA capable.

Summary

A reminder of the items required in order for End to End Digital Encryption on TDMA P25 phase 2.

- APX Portable – Firmware version R15.00.00 or higher
- DVRS/VRX1000 – Firmware version 1.30 or higher
- MSU – Firmware version R15.00 or higher

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