Technical Brief
AN244 Rev A2

Wide Area Wireless Solutions

By Dave Wilk   *Raveon Technologies Corp*

Summary

This document explains Raveon's wireless technology solutions that are used to meet your needs to create large **Wide Area Wireless Solutions** that cover many miles, for campuses, courses, cities, states, or countries. You can enable a best fit wide area IoT or private solution with Raveon Technologies solutions, and this document explains how to do this.

Raveon is an industry leader in *long-range* wireless data modems and wireless GPS tracking. For *short-range* wireless systems, people use Wi-Fi and Bluetooth. For long-range many use cellular modems. However private Wide Areas Wireless Solutions are better in many ways, and Raveon's Wide Area Wireless Solutions are idea for systems to meet numerous requirements.

A. Private communications on YOUR network. You can block remote access.

B. Low cost wireless and no cellular fees. No monthly fees to use private radios.

C. Long range wireless. Raveon's radios communicate many miles even up to 50-100 miles depending upon the terrain. Work off-grid and work anywhere.

D. Fast communications. Messages start being sent in milliseconds, and TDMA is available.

E. Point-to-point, point-to-multipoint, point-(via repeaters)-points including base stations are easy to implement.

F. Great performance at extremely competitive prices.

Wireless Solutions

Data Radio

Modems

Raveon makes many Data Radio modems in a variety of enclosures. The RV-M7 is a popular version and enclosure, and the Tech Series RV-M21 and RV-M22 have a myriad of IO options.

GPS Tracking Modems

All Raveon data radio modems have a GPS tracking feature option for sending GPS location information over-the-air in remote areas.

Mines, race organizations, training services, military training systems, school busses, harbors, helicopters, and many other deployments use Raveon's Wide Area GPS tracking Wireless Solutions.

The tracking messages can go radio-to-radio for remote area tracking, or to a base station to connect to a tracking server to monitor location, speed, direction, altitude, and input status.

OEM Radio Modems

Raveon also supplies modular versions of our radios for companies to incorporate directly into their products. All features described in this document are incorporated within our OEM modules.
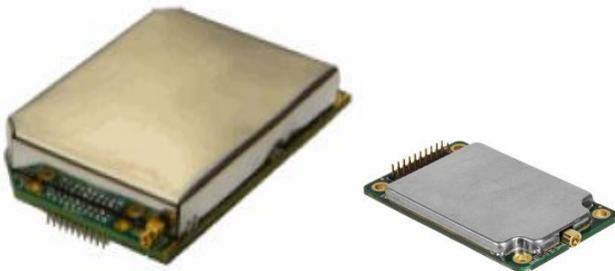

The RV-M8 is a 1-5W radio modem, and the RV-M6 is a miniature 1-2 watt radio modem. The RV-M50 is also a miniature modem module operating in the ISM band.

All of these are ultra long-range, and can be used on your wide area network. We also are willing to create custom OEM versions for you if you need them.

Supervisory Control and Data Acquisition (SCADA)

The Data Radios from Raveon Technologies make ideal wireless modems for SCADA gateways and Remote Terminal Units (RTUs) in SCADA and telemetry systems.

## Wireless Connection to SCADA Slaves (Long Range. Many miles)
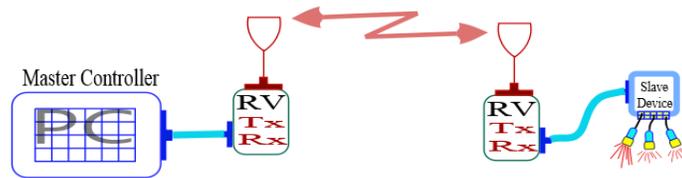
The Tech Series versions have GPIO and FIO options to enable these *Tech Series* products to be complete SCADA RTUs, with many different input and output pins and features. Raveon's wireless modems are excellent devices to connect your things to *Private Networks* or the *Internet*.

When the distance between the Master Controller and the slave being monitored is not trivial, a Wide Area Wireless Link between the two sites becomes a logical means of connecting them.

The Tech Series GPIO interface reduces cost by using it as an RTU without having to buy a slave Device. The GPIO interface can perform many SCADA slave device functions to switch thing on and off, or measure thinks like voltage, temperature, buttons, sensors,…
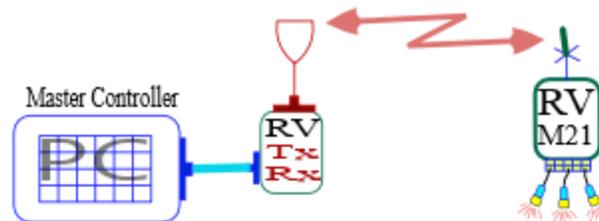
Features in Raveon's Data Radio Modems

1. Long Range Data Radio modems.
   a. 1W, 2W, or 5W RF power output.
   b. Many frequency bands available. VHF, UHF, and ISM.
   c. Sensitive receivers with good interference rejection.
   d. Serial ports can be set to any data rate you want.
   e. OTA data rate is configurable based upon your communication requirements.
2. 16bit ID code. Each data radio can have a different ID code, or group ID.
   a. Receptions can be individual, groups, or ALL.
   b. Repeaters can be setup to repeat based on the ID of the sender.
   c. GPS location reports identify the ID of the radio sending the location.
   d. An Rx address mask can be setup to receive groups and ID ranges.
3. GPS Tracking. All modems have GPS tracking and TDMA option.
   a. Man down locator with alert button
   b. Fast Tracking. Update rate is configurable. Can report every second.
   c. Reports are: location, speed, heading, temperature, voltage, status, inputs.

       d. TDMA timing to avoid RF contention leading to interference.

       e. Atlas version with internal battery-power is available.

       f. GPS trackers can also send data and text messages.

4. OEM Module versions available to put inside your products (M8, M6, M50).

       a. All have same UWORC interface connectors and can use WMX.

       b. 5W long range OEM modem.

       c. Miniature low-cost VHF/UHF 2W modem, RV-M6

       d. License-free versions in VHF (US only) and worldwide ISM bands are available.

5. Tech Series Enclosures have a myriad of IO options.

6. Easy-to-use serial ports. Data-IN transmitted equals received Data-OUT.

7. WMX protocol interface on all radios simplifies custom communication in software.

8. MIMIC mode for remote control.

9. 100X range of Bluetooth or Wi-Fi.

10. Store-and-forward repeater feature available on all products. Put in a remote area to link multiple modem fields together and communicate back many miles.

11. Reliable data. Over The Air (OTA) messages have CRCs and error checking to ensure it outputs correct data via the serial port.

12. AES128 encryption can be enabled on any modem to secure your messages.

13. SCADA Features

       a. One can be base data transmitter Master/Slave

       b. Slave can:

            i. Output Serial data (232, 485, USB …)

           ii. BE SCADA IO with M21 GPIO

          iii. Set Bit, Clear bit, Turn on Bit for xx,

          iv. Count pulses /min/hour

           v. Read input voltage.

       c. Remote control, no software needed.

       d. WMX commands to control up to 65000 remote devices.

       e. Serial data and GPIO simultaneously

14. Weatherproof enclosures are available.

15. 2-year warranty on data radio modems.

16. OTA tests. Modems can be OTA pinged, and OTA commands can be sent to read parameters, and set some parameters.

SCADA Going Wireless

Telemetry Gateway

Wireless modems are the gateway to the wireless telemetry system. When a system uses MODBUS or any other ASCII, RTU, or serial protocol, a Data Radio Modem is the telemetry gateway to dozens or hundreds of remote devices communicating over the radio channel.
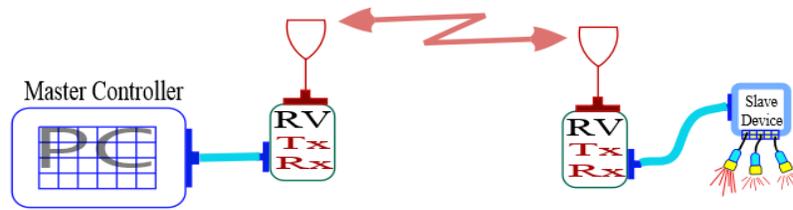
In remote areas, outdoors, the slave device is typically inside of a weatherproof enclosure, and the Radio Modem can be included within the enclosure as well. Install the radio's antenna outside the enclosure.

Use Multiple Raveon Base Stations

If a Master Controller is connected to multiple Radio Modems acting as Base Stations talking to slave devices over radio frequencies, then many more slaves can be accessed. 2 base modems can communicate with 494 Slaves. 20 base modems can communicate with 4940 Slaves. The Raveon data radio modems shown here (RV) can be used as the base stations and as the modems for the SCADA devices. Different groups with different radio base station RVs can have unique GROUP IDs, so groups don't functionally interfere or cross-communicate.
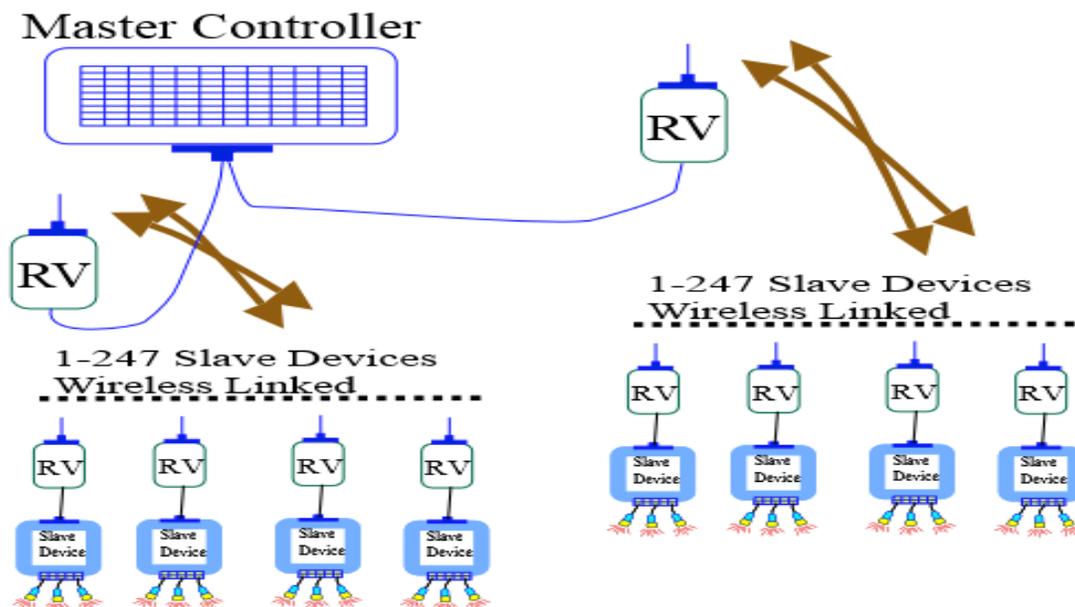

If millions of slaves need to be accessed via Modbus, Modbus can access millions of devices over radio waves, and Raveon's Cigorn Gateway can route the Modbus messages to the correct base station to support millions of devices.

Cigorn Gateway. Connecting to Millions.

Raveon's Ethernet gateway router called **CIGORN** can route your messages to and from the devices you want and the base stations you want to use. It can communicate with dozens of base stations, and each of the base stations can talk to 247 different SLAVE devices or Tech Series SCADA products.

Routing and Cigorn configuration data is stored in an internal SQL database, so you can configure it to ensure the Wide Area Wireless Network Solution is dedicated to working the way you want it to.
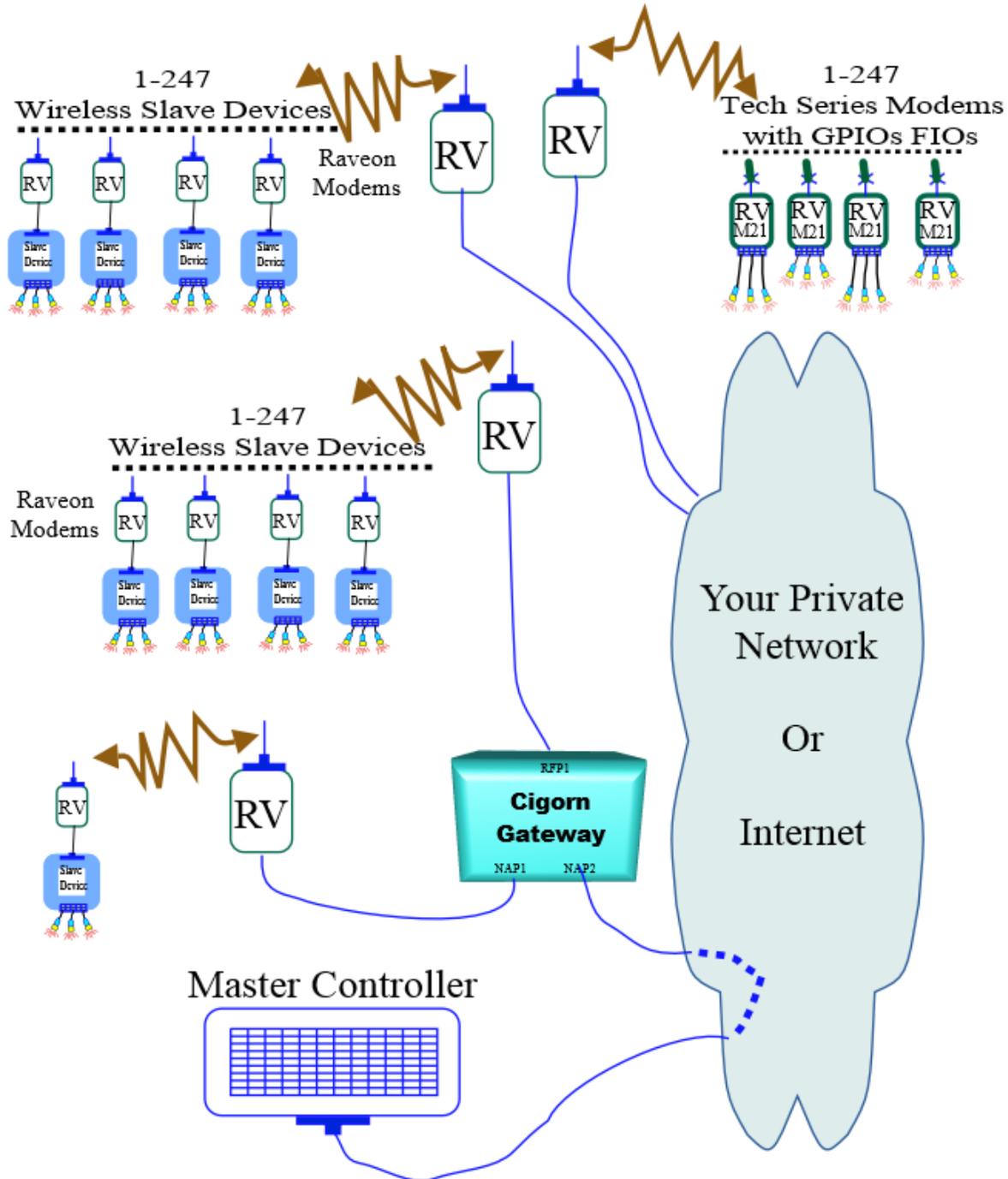
The Raveon data radio modems shown above (RV) can be used as the base stations and as the modems for the SCADA devices. Cigorn can be configured to route as you want, so dozens of base stations can be used, talking to even millions of radio modems or slave devices.

Even MODBUS devices with the same MODBUS ID can be on different radio local systems talking to a local base station, and the radios in the local area only receive the messages sent to their group. Other groups near-by won't get the other group's messages because

each RV base station group can be setup with unique group IDs and Cigorn will route messages to the specific group the way you want.

Cigorn Router Communicates with Many Base Stations

In your system, each base station can talk to hundreds of radios, and each radio can talk to 1-10 SCADA devices with RS-485.

Cigorn Mult-Base Wireless Network Overview
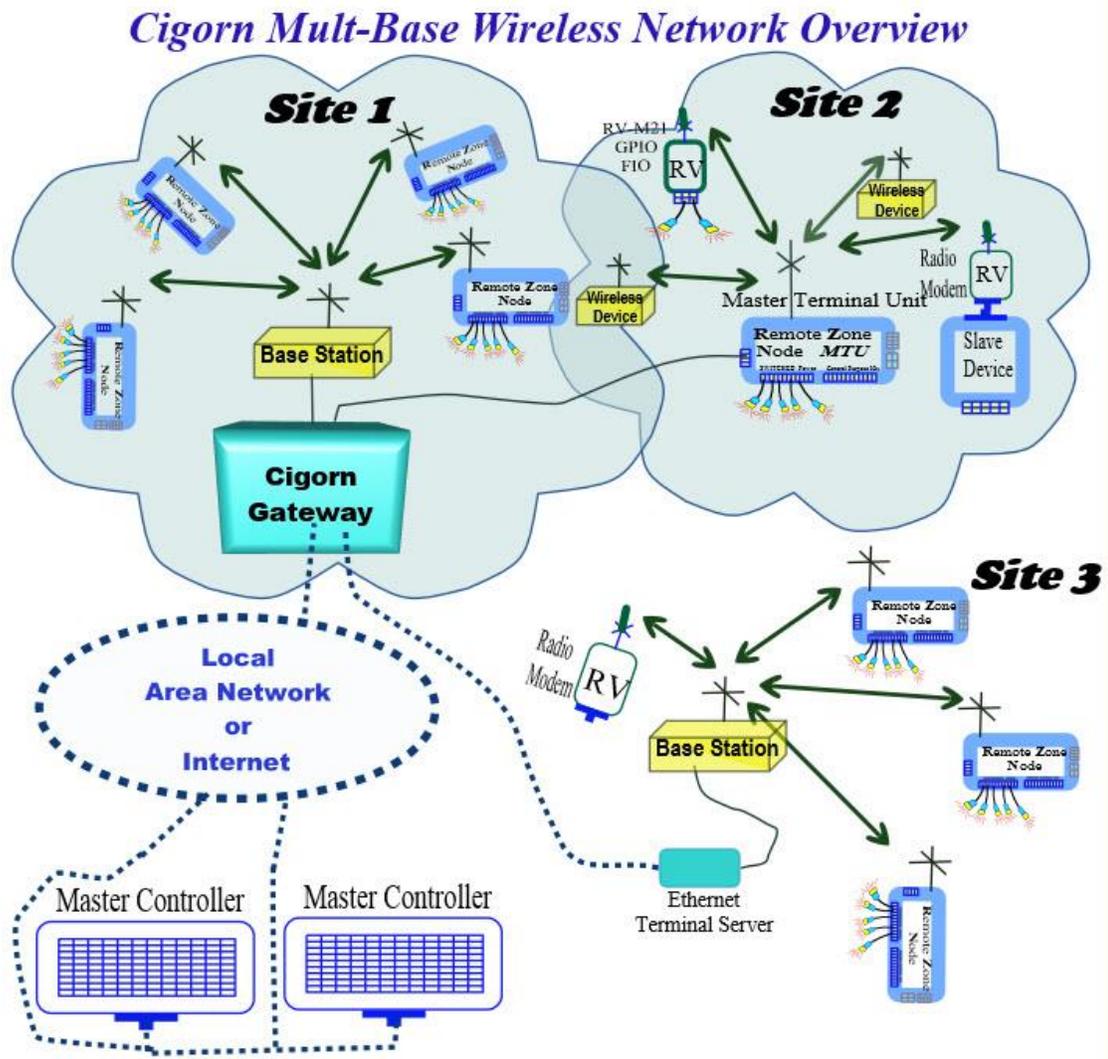
Cigorn can be configured to work the way you need your network to work. So your Master Controller software will work perfectly with the system without having to modify the Master Controller code.

Message Routing

A primary function of the Cigorn gateway software is to route messages to/from the proper wireless device. Messages may originate from a number of different sources:

- Another wireless device on the system
- From a device connected to the Cigorn system, such as a transducer or another computer
- From the Cigorn gateway itself

Routes can be as simple as:

- Route all data from TCP/IP port 1000 to TCP/IP port 1001.
- Route all data from RS-232 serial port 1 to RS-232 serial port 2.
- Route all GPS position data from an RV-M7 radio on serial port 1 to 50 IP addresses on 50 remote computers.

Repeating For Wide Area Extended Range

For ultra-long communications range, high RF noise environments, or obstructed line of sight applications, it may be necessary to use a repeater to establish a reliable communications link.
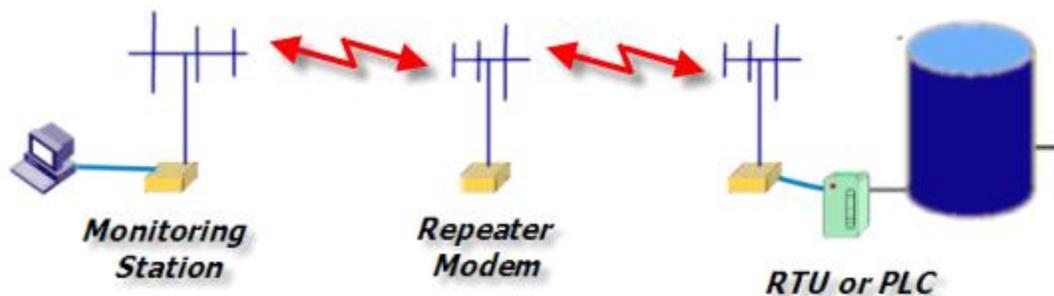
Incorporated in all Raveon Data Radio Modems is a **store-and-forward repeater** function. The repeater function works in the Packet Mode. A repeater can extend the range of a system by 2-20X, depending upon how high-up above the average terrain the repeater is mounted. Repeater systems often cover 100 to 500 square miles per repeater.

Wide Area Base Stations and IoT Interfaces

Raveon's modems work together, and Raveon often creates custom base stations for customers that need special system features. We have designed and manufactured base stations with these features, and can do it again for you.

A. Trunking for utilizing multiple RF channels.

B. Dual receivers and transmitters for reliability, in-case one is damaged, the other one can take over.

C. Meshing the base stations with other RF technology.

D. <u>Auto-connect</u> radios to a base station via secure technology to have radios power-up and connect to the network in the way you want them to.

E. CIGORN can be setup to make your network perform or function the way you want it to. Easily cover a city or a state with 10-30 modems used as base stations connected to CIGORN, and then you can talk to many thousands of radio modems wirelessly.

<u>For additional information, contact:</u>

Raveon Technologies Corporation

2320 Cousteau Court

Vista, CA 92081 - USA

Phone: 1-760-444-5995
Fax: 1-760-444-5997
Email: sales@raveon.com