Raveon M7 GX Frequently Asked Questions

By John Sonnenberg *Raveon Technologies Corp*

How far will a 5-watt UHF radio communicate?

An excellent question, but very difficult to answer. It depends on the following (in order of importance):

1. The height of the antennas above the average terrain.
2. The terrain itself - vegetation and buildings.
3. The over-the-air data rate. For example, 4800 baud works much further than 9600 baud.

There are only two good methods to determine range. Either create an accurate computer model of the system and the terrain, or drive the area and test the coverage. Since these can be impractical at times, here are some "rules of thumb" for 4800-baud communications range. 9600-baud range is approximately ½ of these.

In ***flat wide-open areas,*** such as deserts, grasslands, and farms, vehicle-to-vehicle communications will be 2 miles on the low end and often as much as 10 miles on the high end. A base-station, either with a 15-meter tower or placed on a local hill, will reliably communicate out to 10 miles, and often out to 20-30 miles.

In a ***rolling hills area***, such as much of Nevada, Wisconsin, or Baja Mexico, vehicle-to-vehicle range will be 1-2 miles as long as both vehicles are not in a valley. The range will often go up to 15+ miles as both vehicles crest hills. A base-station, either with a 15-meter tower or placed on a local hill, will reliably communicate out to 7 miles, and often out to 20-40 miles.

In ***mountainous areas or wooded hills***, such as much of Colorado, Tennessee, and northern California, vehicle-to-vehicle range will be ½ - 5 miles and will also be very sporadic depending on the terrain between the vehicles. The ***M7 GX*** takes advantage of this by frequently reporting its position, so that as vehicles crest peaks, they can receive location transmissions from a long way away. Often the vehicle-to-vehicle range will be as far as 15+ miles as the vehicles both crest hills. A base-station placed on a mountain top can extend reliable communicate out to 10+ miles, and often out to as much as 50 miles.

In ***urban areas and cities***, structures will create multi-path and interference, reducing the usable range. Communications will be very similar to operation in

rolling hills. Vehicle-to-vehicle range will be 1-3 miles. A base-station either with a 15-meter tower or placed on a local hill, will reliably communicate out to 5-7 miles, and often out to 10 miles.

Can I add an RF power amplifier for greater range?

If your FCC license allows the addition of amplifiers, they will extend the range. A 10-watt amplifier will not do much, but adding a 25- to 50-watt amplifier can approximately double the range.

How can I improve the communication range?

#1. Use the best antennas you can afford. A good quality mobile antenna has about 4-5 dBi gain. This effectively increases the radio's transmitted signal to 15 watts.

#2. Position the antennas as high as possible. If there is a base-station or repeater in the system, get it's antenna up high and use very low-loss cable to connect it to the radio. To reduce coax cable loss, locate the ***M7 GX*** on the tower instead of running coax cable down the tower to it.

#3. Use 4800 baud instead of 9600 or 19200 baud for the over-the-air rate. The "energy-per-bit" is so much greater with 4800 baud that the range will almost double.

#4. Use more frequent updates. If you have the ***M7 GX*** transmit every 10 seconds instead of every minute, there is a much higher probability that the message will get through in the fringe areas.

#5. If your vehicle has a very noisy ignition/electrical system, install a noise-filter in-line with the DC to the ***M7 GX***. This may help a little.

Can I use a M7 GX for primary navigation?

No. No radio link is 100% reliable, the ***M7 GX*** should not be used as the primary source of navigation or location information.

GPS used in urban environments can suffer from "shadowing" caused by tall buildings, signs, and even large vehicles (anything that interferes with the line-of-sight between the receiver and the satellites to which it is initialized), and also an increased risk of multipath errors caused by glass, steel, and neon sign reflection.

Is vehicle tracking legal?

GPS tracking may be illegal in certain states and in certain circumstances. Our tracking devices may not be used to violate the privacy rights of others, or in violation of local, county, state, or federal statutes. In no way will Raveon Technologies Corp., it's dealers or partners be held responsible for inappropriate use of these products.

IT IS THE SOLE RESPONSIBILITY OF THE BUYER TO CONSULT LEGAL COUNSEL FOR THE INTERPRETATION OF ANY LAWS APPLICABLE TO THE AREA OF INTENDED USE OF THESE PRODUCTS.

What is NMEA?

National Marine Electronics Association (NMEA) 0183 is a combined electrical and data specification for communication between marine electronic devices, such as echo sounders, sonars, anemometers (wind speed and direction), gyrocompasses, autopilots, GPS receivers, and many other types of instruments. It has been defined by, and is controlled by, the US-based National Marine Electronics Association. Although it is a marine-electronics protocol, it is widely used in hand-held and mobile GPS displays and navigation systems.

The NMEA 0183 standard uses an ASCII serial communications protocol that defines how data is transmitted in a "sentence" from one "talker" to one "listener" at a time. Communications is typically at 4800 baud for GPS devices. Through the use of intermediate expanders, a “talker” can have a unidirectional conversation with multiple “listeners.” Using multiplexers, multiple sensors can talk to a single computer port. Third-party switches are available that can establish a primary and secondary “talker,” with automatic failover if the primary fails.

Many GPS receivers have NMEA compatible serial ports on them. The Lowrance 540C and the Garmin 60C are two examples. The ***M7 GX*** speaks the NMEA protocol to these GPSs in order to display numbered icons on their screens at the location it receives from other GPSs.

What Map Datum is used in the M7 GX?

All latitude and longitudes are reported using World Geodetic Survey 1984 (WGS85) datum. Speed is reported in km/hour. Time is UTC as reported by the GPS receiver. Altitude is in meters.

How many vehicles can the RavTrack System support?

The number of vehicle the RavTrack system can support depends upon the desired update rate, the over-the-air baud rate, and the number of repeaters. The maximum is 9999 vehicles on one channel.

The simple answer is: 100 vehicles with updates every 10 seconds, or 1000 vehicles with updates every 100 seconds. This is using 4800-baud over-the-air. At 9600 baud over the air, twice as many vehicles can be tracked.

The ID structure in the ***M7 GX*** modem is 16-bits, allowing for over 65,000 unique IDs, and therefore 65,000 uniquely identified radios. But there are other practical limits to consider in a large system. How often are updates needed? How many RF channels will be used? How many repeaters will be used?

In real-time tracking, each ***M7 GX*** uses some multiple of 50mS time slots to report their positions. For 4800 baud, the ***M7 GX*** needs two slots. If run at 9600 baud, it only needs one slot to report position and status. A typical ***M7 GX*** at 4800-baud over-the-air rate uses 100mS to report its position.

If a repeater is used in the system, then it needs another 100mS to repeat the message, so the number of 50mS time-slots allocated to each unit would be four

(200mS total). This number is programmable in the ***M7 GX***; the factory default is 200mS.

Therefore, in one second, five ***M7 GX*** transponders could report, and have their messages repeated once.

In one minute, 300 transponders could report in. In 5 minutes, 1500. In one hour, 18,000. But only if each one reported once during that interval.

The formula for the number of possible ***M7 GX*** transponders in use at one time is:

N = S X R X U (seconds)

S = Slot time programmed into the ***M7 GX*** (0.10 for 4800 baud 0.005 for 9600 baud)

R = Number of repeaters that must sequentially repeat the transmission (Typical systems will have one repeater.)

U = Update Rate (This is the number of seconds between position reports.)

For systems up to about 300-500 units, this TDMA approach is very efficient. If 1000's of devices must be tracked, and there is only one RF channel available, the Update Rate in the ***M7 GX*** can be set to a small number, such as 10 seconds, but the report-by-exception features should be used. These stop the ***M7 GX*** from transmitting its data unless an exception occurs (input change, speeding, proximity alert, etc.). When exception reporting is used, the RF channel is not used unless an exception occurs. Typically the user will program the ***M7 GX*** to report once-per-hour or once-per-day even if an exception does not occur.

What is the accuracy of the M7 GX's GPS position report?

GPS accuracy is very hard to predict. The GPS receiver in the ***M7 GX*** has these specifications:

- Horizontal <3 meters (50%), <8 meters (90%)
- Altitude <10 meters (50%), <16 meters (90%)
- Velocity 0.06 m/sec

Tests show that the unit-to-unit position difference when two ***M7 GXs*** are very near each other is typically within +/- 0.00001 degrees (1.6meters).

Why not send positions to the GPS satellite?

Unlike other satellite systems, such as Global Star or Iridium, GPS satellites cannot receive data. They only transmit position information for use by GPS receivers. This is a one-way system. Raveon Technologies Corp. uses UHF radio channels to broadcast their position information.

What type of GPS antenna should I use?

For recreational and traveling purposes, standard GPS receiver antennas can be classified into two groups:

1. ***Upright antennas*** (Quadrifilar helix antennas):

Rectangular in shape, mostly visible and external to the main housing of the receiver. They can detect satellites right on the horizon. They cannot normally detect satellites directly overhead and should be held upright for best reception

2. ***Patch antennas***

Patch Antennas are made from a flat patch internal to the antenna's housing. They can detect satellites directly overhead but cannot detect satellites on the horizon. They should be held flat for best reception.

The ***M7 GX*** receiver will work with a typical passive antenna, but performance (acquisition speed and signal tracking) will be improved if an "active" antenna is used. Active antennas actively amplify the GPS signal before sending it to the ***M7 GX's*** GPS receiver. This also helps compensate for the signal loss through the cable.

The ***M7 GX*** applies 3.0-3.3 V DC on the center-conductor of the GPS antenna connector. This voltage is used to power and active GPS antenna.

Do not plug a GPS antenna that connects the center-conductor to ground into the ***M7 GX***.