# RUNNING A CELL PHONE MODEM ON SOLAR POWER Application Note 10

## INTRODUCTION

The Motorola Cell Phone Modem uses more power than the Davis Solar Power Kit (#7708) and Davis battery (#7711) can generate and backup. The Note discusses power management methods that can solve this problem.

## ESTIMATING POWER REQUIREMENTS

There are three major factors to consider:

- The current required to run the weather station, RS-232 link, and sensors. A Wizard (#7420) or Monitor (#7440) system draws about 15 mA. The advanced stations, including GroWeather and Health Enviromonitor, draw about 20 mA. In all cases backlit lighting is assumed to be off. Use of backlit lighting is not recommended for solar panel operation. The weather station must remain powered at all times to retain its settings and data memory. The current draw per day will therefore range between 0.36 and 0.48 Amp-Hours.
- The current used by the cell phone modem in standby mode. This is about 200 mA or about 4.8 Amp-Hours per day. This is considerably more than the solar panel can deliver so the cell phone modem must be turned off for a large percentage of the day. For the Monitor or Wizard, a timer/relay (#7682) is used to program and control the period each day that the Cell Phone Modem is able to receive calls. The advanced weather stations can use the timer/relay (#7682) or the alarm output module (#7736) for the same purpose.
- The current used by the Cell Phone Modem in transmit mode. This averages about 2 Amps; the Amp-Hours depend on the connection time each day. For example: if the archive interval is set for one minute, it would take about 9 minutes to download all of the data records from the weather station. If done once a day this would consume about 0.3 Amp-Hours. If the archive interval was set longer, say 30 minutes, the Amp-Hours needed would drop to about 0.02 Amp-Hours. Both are well within the charging capability of the solar panel.

Assume that the solar panel can generate 50% of its rated capacity or about 2.4 Amp-Hours per day. (See Application Note 9, *Estimating power from the solar panel.*) A workable setup with some safety margin would be as follows:

| | |
|---|---|
| Solar energy generated in a 24 hour period - | 2.4 Amp-Hours |
| Run weather station continually for 24 hours - | -0.48 Amp-Hours |
| Enable cell phone modem standby for 1 hour - | -0.20 Amp-Hours |
| Cell Phone Modem transmits for 20 minutes - | -0.66 Amp-Hours |
| Net reserve | 1 Amp-Hour per day |

This reserve insures that the battery stays fully charged and could deliver 4 days of operation in the event the solar panel fails or sunlight is abnormally obscured by heavy cloud cover or snow. It would also take about 7 days to recharge an almost discharged battery after the typical sunlight levels returned to normal. This example would be suitable for a typical temperate climate location. Also, for the typical archive interval of 15 to 30 minutes, the data could be downloaded daily, yet still leave about 2 hours per week to view the bulletin. However, your mileage may vary, so limit the number of hours per day that the cell phone modem is enabled and accessed to no more than you really need.

## SITUATIONS THAT MAY REQUIRE MORE POWER

Sometime a situation may require more power than the Davis Solar Panel Kit and battery can generate. This section details two situations in which you need to increase the capacity of the solar panel kit.

- You want to operate the cell phone modem for more than 20 minutes each day. It may be that you need the larger operating time for only 1 or 2 days a week. This might still keep the average current draw within acceptable levels. In this case install the timer/relay (#7682), which may be programmed for each individual day of the week. If you want to operate the Cell Phone Modem every day for longer than 20 minutes, you will need a larger solar panel and storage battery. The exact requirements are highly variable, depending on modem operation, average solar radiation output, and periods of reduced solar output. A conservative rule of thumb would be to use a 15 watt rated solar panel capacity and a 12 Amp-Hour battery for the first hour of modem connection time. For each additional hour add 10 watts to the solar panel and 8 Amp-Hours to the battery. For example, if you wanted to connect 2 hours each day, you would install a 25 watt solar panel and a 20 Amp-Hour battery.
- The remote site experiences long periods during which the panel can generate little or no power and the transmit requirements of the cell phone modem are less than 10 minutes per day. In this situation, a larger storage battery may be all that is needed. A commonly available size 24M deep cycle battery can store about 75 Amp-Hours and could operate a system for about 75 days with no solar charging. This battery can be housed in an inexpensive battery case located on the ground at the base of the weather station. Once sunlight is restored it would take about 2.5 months to fully recharge the battery, so this approach is only useful where there is a very predictable time of no solar charging followed by a long period of solar charging.

Larger solar panels are available from many alternate energy suppliers. A larger solar panel will require a suitably sized regulator. West Marine Products sells a complete line of rugged solar panels and regulators for the recreational boating market. Contact 1-800-538-0775 for further information.

Larger capacity storage batteries can battery cases are available from many RV and boating suppliers. Also, most Sears Battery and Tire Centers carry deep cycle batteries and cases. Die Hard Model 96494, a deep cycle 24M battery cost $59.99 in July 1997.

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