

## Resolving Radio Range Issues

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Radio range issues are best resolved by analyzing five factors: the environment, the antenna, the antenna's cables, the battery and the radio itself. Answering the following questions may help you troubleshoot your system and improve range.

### A. Environment (terrain and ambient noise)

1. Have other radios given better range in the same area? If not, terrain may be a factor. (If so, was the radio with the better range configured the same: same over-the-air baud rate, same frequency, same channel spacing, etc?)
2. Does range improve when you move to flatter areas or areas without buildings, trees and hills?
3. Are there airports, seaports or radio towers nearby? Radars and other radio emissions can greatly reduce range.
4. Are you using an itinerant frequency? These are crowded in many areas and interference from other users can greatly reduce range.
5. Have you used a scanner to check for radio interference on your licensed frequency?

### B. Antenna

1. Are you using a "mobile whip" antenna? These work much better than the so-called "rubber duck" antennas.
2. Is the frequency range of both the upper and lower elements of the whip antenna the same as that of the radio?
3. Does the upper element of the whip antenna have the same gain as the lower element, i.e., are both either 0 db ("Unity") gain or 5 db gain?
4. Is the freq. band the same as the radio?
5. How high is the antenna off the ground? It should be as high as possible. The easiest way to elevate the antenna is with an antenna mast.
6. If your antenna has a metal spring clip at the bottom, is it compressed so that it cannot make contact with the radio or cable adapter? If so, gently pry the clip out.

### C. Antenna Cables

1. How long is the cable between the radio and the antenna? The shorter, the better. You can see how cable length affects range by running the PCCCalc Range Estimator program, which is available for free download from <http://www.pacificcrest.com/downloads/software.shtml>.
2. What type of cable are you using? LMR200 cabling is much more efficient than RG58.
3. Is the cable damaged? You can test this by swapping out the antenna cable if you have another one.

#### D. Battery, cable and connectors

1. How old is the battery? All “12V” batteries output 13.8V when new but their maximum voltage drops with age. Batteries typically can be charged 300 times before rapidly losing the ability to output the 9V required by most radio modems for transmission. This can occur within two to three years of normal use. All batteries eventually reach a point in their lives when they can still output 9V during the radio’s receive cycle but fail to deliver 9V during the radio’s transmit cycle. The radio will receive properly but its transmit range will drop significantly. Unfortunately, standard voltmeters cannot tell you if a battery’s output voltage is less than 9V during the radio’s transmit cycle because the transmit cycle (about 1/10 second) is too short. We recommend instead that you mark batteries with the date of first use and replace them after 300 charge cycles or two years.
2. How hot/cold is it? Extreme temperatures can reduce a battery’s power output.
3. What is the condition of the battery cable? The battery may fail to deliver full power if the cable is frayed, cracked, etc.
4. What is the condition of the battery connectors? The battery may fail to deliver full power if its connectors are dirty. Cleaning with a brush and contact cleaner is recommended every few months.
5. What type of clips are you using? The battery may fail to deliver full power if you use alligator clips.

#### E. Radio

1. It is common to compare the range of one radio with that of another when the two radios do not have the same output power, are attached to different types of antennas, cables, and batteries or are configured for different modulation types. The easiest way to estimate your range based on the radio’s configuration is to run the PCCCalc Range Estimator program, which is available for free download from <http://www.pacificcrest.com/downloads/software.shtml>.
2. Are you using the latest release of firmware in the radio? Free downloads are available at [http://www.pacificcrest.com/tech\\_support/updates.shtml](http://www.pacificcrest.com/tech_support/updates.shtml).
3. Are you using the radio as a base, a repeater or a rover? You should set the Digisquelch parameter to “Low” when using a PDL radio as a base. Set it to “High” when using it as a rover or repeater. The “Moderate” setting should be used only when it eliminates interference when the radio is set to “High.”
4. Are you avoiding the radio’s harmonic frequencies? Harmonics of the unit's reference crystal can internally interfere with received signals at frequencies that are an exact multiple of 18.000 MHz, such as at 414.000 MHz, 432.000 MHz, 450.000 MHz, and 468.000 MHz.
5. If the “Amp Pwr” light on the front panel is flashing, the PDL High Power Base radio has probably overheated. When it does this, it automatically shuts off the 35W amplifier to prevent damage to the electronics and switches on the 2W amplifier. This reduces both the internal temperature and the broadcast range significantly. You should wait until the radio has cooled down and then power-cycle it.