

## Why Does My GPS Not Match the Course Measurements?

Satellites are the cause for much of the error. GPS units calculate distance based on triangulation of readings taken from a series of fixed orbiting units, but the degree of accuracy depends on several factors.

GPS watches typically worn by runners can't achieve the results obtained by survey- or military-grade units, which sometimes use two base units that can read the satellite signals at a higher degree of precision. *Even the best commercially-available GPS unit is only accurate to about 12 feet at any given time, and can be hundreds of feet off in accuracy.* Most units will indicate what their current accuracy is, and it can vary from 12 feet to 350 feet or more.

GPS units must have a clear view of at least three satellites to get a reading, and the more they can acquire, the more accurate they are. However, trees, buildings, and even a runner's body can interrupt the signal, making it less accurate at any time.

Further, they only check their position periodically, not constantly. Some units check every second, some every 20 seconds. The user can sometimes set the unit to check at certain time or distance intervals, but if it has lost contact with the satellites, it can't tell where it is, so it misses that checkpoint. So, if someone is running quickly, they may make a few turns while the unit doesn't have contact, so that section will be measured incorrectly.

The other part of the equation is the way the runner ran the course versus the way it was measured. A certified course is measured along the Shortest Possible Route (SPR), a line that cuts all the tangents just one foot from the curb or road edge. Very few elite runners, with an unimpeded road available to them, tend to run that tightly. For those farther back in the pack, the crowd of runners around them makes this almost impossible, and possibly not worth the extra effort it would require to weave through the field to follow the SPR. Also, runners may start their watches before reaching the actual starting line and stop them after the finish.

These two factors are the primary cause for readings that don't agree with the actual course distance. Tests performed by members of USATF's Road Running Technical Council have found that runners usually will get a reading indicating the course is 1 percent long. (Several threads on the topic are available on the RRTC Bulletin Board at <http://measure.infopop.cc/eve>).

Strictly speaking, all certified courses are long, since a 0.01 percent Short Course Prevention Factor is added to ensure they don't come up short and fail validation in case of a record, but that is probably not enough to explain the longer readings obtained by runners' GPS units. The RRTC's statement on GPS measurements is available at <http://www.usatf.org/Products/-/Services/Course-Certifications/USATF-Certified-Courses/Certify-Your-Course/Statement-on-GPS-Use-by-Runners.aspx>.

*\*Courtesy of the Cherry Blossom 10 Mile Run*