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Geospatial Extension Program

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Three Garmin GPS Units Tested and Compared

Advances in GPS technology keep pushing the limit on what is possible with consumer handheld units. Faster processors with lower power requirements, advances in software, and improved GPS algorithms promise much better accuracy and improved battery life.

These three Garmin handheld units each use different high-sensitivity GPS chipsets. From left to right, the GPSmap 60Cx, Oregon 300, and Colorado 400t. These units are superior to earlier models in TTFF (time to first fix) and in tracking under tree canopy.

History

In 2005, a new and exciting development occurred in the handheld GPS market when the SiRFstarIII chip was introduced. It was the first chip that had amazing sensitivity with miserly power requirements. Before then, it was unheard of to receive a GPS position indoors. Now, it is common to have a GPS receiver work in a home or business. This chip set a high mark for other chip designers to aspire to. Even today, all new GPS chips are compared to that chip for accuracy, sensitivity, and power. It was truly the beginning of the processor wars in the GPS world.

Next Generation

Today, we find ourselves with not only the venerable SiRFstarIII+ chip, but a host of other chips that promise faster satellite acquisition time, greater sensitivity, and lower power draw. Two chips that Garmin has chosen to use in its new Colorado and Oregon units is the MediaTek (MTK3318) and the STMicro Cartesio (STA2062), respectively.

The SiRF III chipset was the first to promise improved accuracy and the ability to determine position indoors. (Photo courtesy of SiRF Technology Holdings, Inc.)

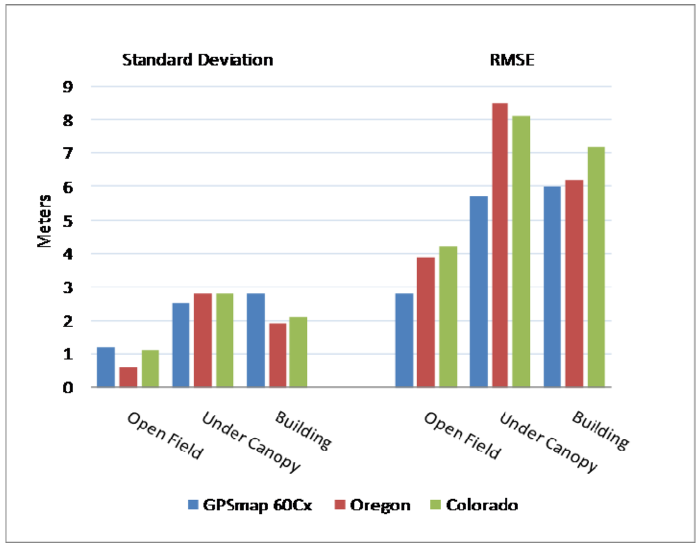
We wanted to find out how these new chipsets compared to the SiRFStarIII found in the GPSmap 60Cx. We decided to test these three GPS units and compare them to determine if there was a new chipset to crown as "best in class".

Testing Method

The test was conducted in two parts. First, the units were tested to determine their TTFF (time to first fix). This is the time it takes to obtain a GPS position after initial startup time. This test is correlated to the processor speed and sensitivity to GPS signals. The second test was to determine their accuracy. This was done by establishing a serial connection between each GPS unit and a Pocket PC unit and gaining a good GPS lock for fifteen minutes to update all almanacs and eliminate any bias brought about by differences from internal clocks. The units were then tested in an open field, under a tree canopy, and beside a building (for multi-path situations) to simulate different environments the GPS units will encounter. The units were placed in a known spot (RTK accuracy ±2cm) and tested simultaneously to eliminate differences in the satellite constellation that occur over time. The software VisualGPSce was used to monitor and log GPS positions and calculate the standard deviation of position. The average position standard deviation was recorded and graphed.

Results

The chart below contains the TTFF results and the graph shows the results of the accuracy test. The Oregon has the shortest TTFF, only 1 second on a warm boot and an easy 28 seconds on a cold. This is due to the chipset having a feature called HotFix where the unit calculates where the satellites will be in the future, this gives it a great advantage in finding the satellites when it is turned off and then back on.



The accuracy test is slightly mixed with all having a small standard deviation. The RMSE calculated how far they were from the "true" position. In this test, the GPSmap60Cx was better in all environments. The Oregon, with a ceramic antenna built-in, seemed to struggle under a canopy situation. However, it performed better than older units (e.g. Garmin Legend) in similar situations.

This review was performed, written, and edited by S. Chod Stephens and V. Philip Rasmussen as part of the ongoing Utah Geospatial Extension Program.

Feature	Colorado	Oregon	GPSMap 60CSx
Touch screen	No	Yes	No
Rock'n Roller	Yes	No	No
Lanyard attachment	No	Yes	Yes
Weight	7.3 oz (206.9 g)	6.8 oz (192.7 g)	7.5 oz
Antenna	Quad-helix	Ceramic	Quad-helix
Display resolution	240x400	240x400	160x240
External storage	SD	Micro SD	Micro SD
Storage card location	separate slot	under battery	under battery
GPS Chipset	MediaTek MTK MT3318	STM Cartesio STA2062	SiRFStarIII, or MTK3329
External antenna connector	Yes	No	Yes
Hard buttons	2+2D Rocker + Power	Power	8+4D+Power
Battery life (2700 mAh NiMH)	14-18 hrs	13-21 hrs	16-20 hrs
Power-on to first screen	18 sec	14 sec	8 sec
TTFF - Time to First Fix (Cold-Warm)	41-9 sec	28-1 sec	39-7 sec
HotFixTM (fast location fix)	No	Yes	No
Text/data entry format	Rock'n Roller	Grid style	4D controller
Fast "mark waypoint" capability	Yes (press hold enter)	No	Yes
Waypoint averaging	No	Yes	No

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