RYSAVY
R E S E A R C H

Test Report March 26, 2008

GPS Performance: RIM BlackBerry versus Competing Devices

Executive Summary

RIM BlackBerry GPS-enabled devices employ an extended ephemeris system that enables fast acquisition of satellite data. This system is significantly faster than competing devices. Rysavy Research conducted a series of tests that showed the RIM system to be two to seven times faster than products from leading vendors such as HTC and Nokia.

Ephemeris data is information about GPS satellites such as velocity and position that reduces the Time to First Fix (TTFF). Stand-alone GPS devices cache this information, allowing reduced TTFF. However, the cached data is only good for about four hours, resulting in longer TTFF after the data expires. Some devices, such as RIM BlackBerry, use the data channel to obtain extended ephemeris data from an Internet-based server, enabling faster TTFF for up to 72 hours between readings. Devices automatically obtain new extended ephemeris data as needed. RIM BlackBerry had the best GPS performance in both cached and extended ephemeris data scenarios.

> **Depending on the user scenario, RIM BlackBerry devices had**
> **two to seven times faster GPS performance than competing devices**

Test Description

Rysavy Research[1] compared GPS performance of the RIM BlackBerry 8800 and the BlackBerry 8310 (Curve) against the Nokia N95, HTC 3600 and Mio A701, all new and leading mobile converged devices that have GPS capability. Test engineers used map applications to initiate and detect location fixes. To avoid using cached location data, test engineers obtained consecutive fixes from locations at least 1 kilometer apart. The test consisted of launching the map application, beginning time recording, acquiring a location fix and stopping the time recording. Test engineers conducted multiple types of tests with each device and recorded the results. For completeness, test engineers also recorded various other items such as time of day, weather conditions, a location code and positional dilution of precision.

Rysavy Research conducted three types of tests, shown in the following table.

Test	Wireless Data Network Available	Time Between Measurements	Cached Ephemeris Data	Extended Ephemeris Data
1	No	Long (greater than 5 hours)	Expired	Not available
2	Yes	Short	Available	Not needed
3	Yes	Long (greater than 5 hours)	Expired	Available on some devices

Test 1 showed the results of having neither cached nor extended-ephemeris data available, while using a non-maps GPS application to eliminate any potential variation in the way the GPS chip interfaces with the maps applications. This is not a common user scenario, but was performed as a control test. Test 2 measured when the interval between measurements was short (e.g., 15 minutes), allowing the device to use cached-ephemeris information with a maps application. This scenario provides the best TTFF values. Test 3 used a longer interval (typically 8 or 16 hours), also with a

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[1] Engineering services provided by Quality in Motion, Inc.

maps application, to measure TTFF after the cached-ephemeris data had expired, to assess the benefits of extended-ephemeris data.

Test Results and Analysis

To achieve repeatable and reliable results, test engineers took ten measurements for each device for each test case. To protect against individual device anomalies, Rysavy Research also used two of each device type. Given some variability in the test results, Rysavy Research analyzed the data using two methods. In the first method, the analysis included averages and standard deviations of all the values. In the second method, the analysis excluded the value in each group of measurements that was the farthest from the mean value, referred to in the test results as the outlier. The analysis also excluded cold-start values in tests 2 and 3.

Test results for test 1 (no ephemeris available), with outlier values removed, averaged 41.2 seconds for BlackBerry devices, 46.8 for the Nokia N95, 50.3 for the HTC P3600 Pro, and 38.2 for the Mio A701. The relatively high values measured in this control test demonstrates the value of cached and extended ephemeris methods.

Table 1: Cached Ephemeris (test 2)

Unit	Outlier Included Average TTFF	Std. Dev.	Outlier Removed Average TTFF	Std. Dev.
BB8800 - A	5.1	1.1	4.9	0.8
BB8800 - B	5.5	1.6	5.2	1.4
BB8800 - Combined	5.3	1.4	5.0	1.1
BB8310 - A	7.2	4.9	5.6	1.0
BB8310 - B	5.7	0.8	5.5	0.6
BB8310 - Combined	6.5	3.5	5.5	0.8
Nokia N95 - A	17.3	1.2	17.6	0.9
Nokia N95 - B	14.4	1.6	13.9	0.8
Nokia N95 - Combined	15.9	2.0	15.8	2.1
HTC P3600 Pro - A	15.1	3.7	14.4	3.1
HTC P3600 Pro - B	12.1	1.6	11.8	1.4
HTC P3600 Pro - Combined	13.6	3.2	13.1	2.7
Mio A701 - A	11.6	1.9	11.1	1.6
Mio A701 - B	9.7	1.2	9.3	0.6
Mio A701 - Combined	10.6	1.9	10.2	1.5

Table 2: Extended Ephemeris (test 3)

Unit	Outlier Included Average TTFF	Std. Dev.	Outlier Removed Average TTFF	Std. Dev.
BB8800 - A	7.1	0.9	7.1	0.9
BB8800 - B	7.1	0.5	7.1	0.5
BB8800 - Combined	7.1	0.7	7.1	0.7
BB8310 - A	8.3	1.1	8.3	1.1
BB8310 - B	8.0	0.9	8.0	0.9
BB8310 - Combined	8.2	1.0	8.2	1.0
Nokia N95 - A	27.5	3.3	28.2	2.5
Nokia N95 - B	27.4	1.4	27.0	1.1
Nokia N95 - Combined	27.4	2.5	27.6	2.0
HTC P3600 Pro - A	57.8	3.6	58.6	2.8
HTC P3600 Pro - B	53.6	5.5	52.5	4.8
HTC P3600 Pro - Combined	55.7	5.0	55.5	4.9
Mio A701 - A	45.2	5.7	46.6	4.0
Mio A701 - B	42.1	5.8	43.5	4.3
Mio A701 - Combined	43.6	5.8	45.0	4.3

Table 1 shows the time required to obtain a location fix using cached ephemeris. For the outlier values removed, BlackBerry devices averaged 5.25 seconds, the Nokia N95 averaged 15.8 seconds (three times slower), the HTC P3600 Pro averaged 13.1 seconds (more than twice as slow), and the Mio A701 required 10.2 seconds (about twice as slow.)

Table 2 shows the time to obtain a location fix after cached ephemeris information has expired, but where some devices, like BlackBerry, can leverage extended ephemeris. For the outlier values removed, BlackBerry devices averaged 7.65 seconds, the Nokia N95 averaged 27.6 seconds (three times slower), the HTC P3600 averaged 55.5 seconds (seven times slower), and the Mio A701 averaged 45 seconds (almost six times slower.)

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