THALES


# MobileMapper™ CE

## WHITE PAPER

Mobile Mapper CE
Accuracy and Performance
in Real-World Conditions

## Introduction


*Figure 1: Thales MobileMapper CE Unit.*

Since its introduction, MobileMapper CE has been enthusiastically accepted by the market.

MobileMapper CE provides accuracy, performance and high value. To underscore the accuracy and performance of this solution, stringent testing was performed and recorded here to better inform potential users and the industry.

This real-world performance was measured under the three most common data collection scenarios in mapping work:

- Open Sky Conditions
- Suburban Environment
- Tree Canopy

The results of the testing clearly prove that:

- MobileMapper CE is sub-meter accurate in the 3 data collection scenarios.
- The ability to adjust the sensitivity level of the MobileMapper CE dramatically increases its productivity under foliage.
- The MobileMapper CE has excellent responsiveness in dynamic data collection, i.e. lines and areas.

In all of the tests the default GPS settings were used, namely:

- Maximum PDOP: 6
- Minimum SNR[1]: 30
- Elevation Mask: 10

WAAS corrections were used throughout all of the tests with the exception of the foliage data collection where RTCM corrections from the MobileMapper Beacon were used.

1. Signal To Noise ratio expressed in dBHz.

## Tests Conducted in Open Sky Environment

To get a useful picture of how MobileMapper CE performs in an open sky environment, a surveyed grid of nine points in an open field was set up in a business park. This test grid was used for collecting both point and line data. Figure 2 below shows the data collection environment.

*Figure 2: Open Sky Testing Environment.*

## Point Feature Data Collection under Open Sky

A series of stop-and-go data sets were collected on the points on the grid. Equipped with a MobileMapper CE, the operator occupied a point for one minute, then walked around the immediate area with the receiver for two minutes before re-occupying the original point.

This procedure was repeated 15 times at each point. The goal was to show the accuracy and repeatability of occupying a point as well as the transition between dynamic and static measurements.

The results of these tests are summarized in Table 1.

*Table 1: Open Sky Accuracies.*

| Ref. point | HRMS[a] (m) | CEP[b] (m) |
|---|---|---|
| 1 | 0.57 | 0.60 |
| 2 | 0.50 | 0.36 |
| 3 | 0.47 | 0.31 |
| 4 | 0.43 | 0.25 |
| 5 | 0.77 | 0.67 |
| 6 | 0.50 | 0.49 |
| 7 | 0.39 | 0.20 |
| 8 | 0.37 | 0.26 |
| 9 | 0.45 | 0.27 |

a. HRMS: Root Mean Square of all the points in a scatter plot computed against the true antenna position.

b. CEP: A circle's radius, centered at the true antenna position, containing 50% of the points in the horizontal scatter plot.

**MobileMapper CE consistently and comfortably delivers sub-meter accuracy using SBAS[1] corrections.**

1. Satellite Based Augmentation System: WAAS in North America, EGNOS in Europe. Note that only WAAS was used in the test. EGNOS may provide different results.

## Line Feature Data Collection under Open Sky

To show MobileMapper CE's GPS performance in dynamic mode, line features were collected in the same open field using MobileMapper CE in a one-second streaming mode. The operator walked around the grid making sure that he passed over each of the centimeter-accurate survey points.

Figure 3 below shows what happened when the operator walked along the grid. The cross points represent the RTK control points recorded with a Thales Z-Max receiver. The results again show that MobileMapper CE meets the sub-meter accuracy specification, this time in dynamic mode in an open sky environment. The least accurate pass over a point (upper left-hand corner) is off by 1.05 m. The rest of the control point/line intersections are within 1 m of the control point, the best being within 24 cm.

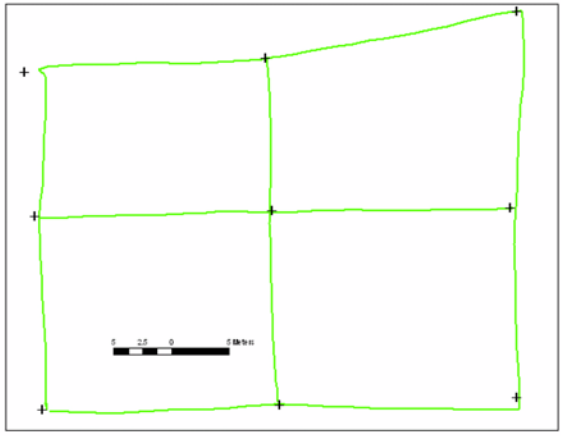

*Figure 3: Dynamic line data collection in an open sky environment.*

**The MobileMapper CE shows excellent responsiveness in dynamic data collection environments.**

## Mobile Mapping in the Suburbs

To test the performance of MobileMapper CE in a typical suburban setting a sidewalk data mapping project was completed. The test was conducted in a relatively old suburban neighborhood with several large oak trees and one- and two-story buildings set close to the sidewalk (see Figure 4 below).

*Figure 4: Sidewalk in the suburban neighborhood used in suburban test.*

The MobileMapper CE was set to its default GPS settings, using the internal antenna and applying WAAS real-time differential corrections. The sidewalk was mapped by streaming data at an interval of one second.

Figure 5 below shows the test result. The green dots on the map represent the RTK control points recorded with a Thales Z-Max receiver. The yellow lines indicate sidewalks surveyed with a MobileMapper CE.

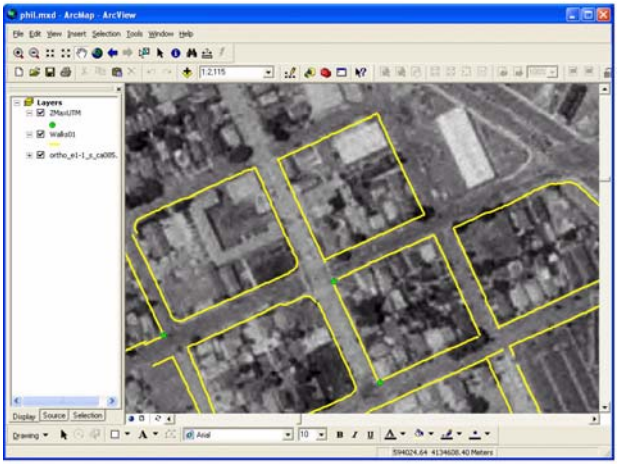


*Figure 5: Line features collected by MobileMapper CE in a suburban environment.*

Figure 5 above illustrates the smoothness of line data collected with the MobileMapper CE in a suburban environment.

Reviewing the data set revealed that the data collected with the MobileMapper CE was in all cases within 1 meter of the centimeter-accurate control points surveyed with the Thales Z-Max receiver.

Figure 6 shows the excellent level of precision obtained. At one of the street intersections where the MobileMapper CE user had to walk over a Z-Max-surveyed control point, the test shows that the logged line and the control point are only less than 16 cm apart.

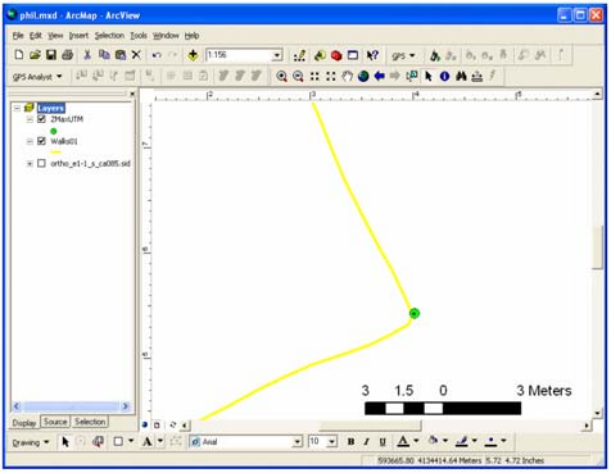


*Figure 6: Overlap within 16 cm of the control point.*

**MobileMapper CE settings are optimized for performance in suburban environments.**

## Tree Canopy Data Collection

The final test scenario was designed to test the performance of the MobileMapper CE under foliage. For this test the foliage was deciduous trees (Eucalyptus) as shown on the two photos of Figure 7. The test was done during the summer.

*Figure 7: Foliage test setup.*

Data were collected over a control point surveyed by using a Theodolite. For this test, RTCM differential was used streaming via Bluetooth from a MobileMapper Beacon. Eight 60-second static occupations were completed.

*Table 2: Accuracy under foliage (m).*

| Occupation | Horizontal Error |
|---|---|
| 1 | 0.71 |
| 2 | 0.16 |
| 3 | 0.15 |
| 4 | 0.20 |
| 5 | 0.38 |
| 6 | 0.13 |
| 7 | 0.13 |
| 8 | 1.06 |

Several things are clear from the data. First of all, the accuracy of the MobileMapper CE is very good, given the nature of the setting. Only one point was outside 1 m of accuracy and in that case only by 6 cm. Secondly, MobileMapper CE was able to collect data during all eight occupations in circumstances where one would normally expect to lose lock at least some of the time. For this test, the SNR mask was set to 30 dBHz.

The fact that MobileMapper CE is so productive under foliage is partly due to the ability to set the SNR mask in the receiver. The range is from 24 to 32 dBHz with the default setting being 30. The user can adjust this level to obtain position data even in very dense foliage. For example, setting the SNR number to the lowest possible level (24) means that the MobileMapper CE will only reject signals with an SNR of less than 24, a setting that should be used only when a position is absolutely required even with the possibility of some error.

## Conclusion

Our tests have confirmed what our users already know: that MobileMapper CE provides solid data collection results in a wide range of conditions at sub-meter accuracy.

**Key Findings:**

- MobileMapper CE meets the sub-meter accuracy specification, in dynamic mode in an open sky environment.
- MobileMapper CE is comfortably within the sub-meter accuracy specification in a stop-and-go mode.
- MobileMapper CE is consistently productive under foliage. In rare instances, when very dense foliage causes accuracy to fall outside the sub-meter range, an optional external antenna can easily improve results to sub-meter quality.
- By giving users the freedom to set SNR masks for different foliage conditions, MobileMapper CE meets the challenge of producing a necessary position every time it is required. This feature is highly valuable for users who are willing to loosen accuracy requirements in order to acquire a needed point.

MobileMapper CE achieves impressive performance both in accuracy and reliability. As a GIS solution with a breakthrough position in the market, MobileMapper CE delivers on the promise of high-quality mobile mapping with price point and ease-of-use accessibility that can expand the addressable market of users.

From utility asset management to forest mapping applications, MobileMapper CE not only produces positive data under optimal conditions in a laboratory, but brings optimal GIS accuracy and performance under the real-world conditions our customers are faced with every day.

# MobileMapper CE

## White Paper


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