LT700H RTK ANDROID TABLET

White Paper

Mapping & Geospatial | October 2019

Make your work more efficient

Contents

1. Introduction

The LT700H GNSS RTK tablet is the ideal companion designed to increase efficiency and productivity of mobile field work force in different industries and applications requiring centimeter to decimeter accuracy positioning.

Rugged and lightweight, the LT700H is a versatile Android-based tablet to collect 2D high-quality data construction for pre-site surveys, precision GIS data collection, forensic mapping, construction layout, environmental surveys...

Connecting the LT700H to RTK network correction services (NTRIP) produces high accuracy positioning solution within seconds through its built-in dual frequency full constellation GNSS module covering GPS, Glonass, Galileo and BeiDou systems.

Besides its full compatibility with CHCNAV LandStar 7 Survey Software, the LT700H enables accurate positioning to any existing Android survey, mapping and GIS software.

The extensive coverage of full GNSS NTRIP RTK correction services provided by CORS networks operators and the valued positioning of CHCNAV LT700H open the possibility for GIS professionals to access to high precision GNSS data collection.

This whitepaper presents the positioning performances of CHCNAV LT700H in various environments and configurations:

- Attached compact helix antenna
- Geodetic grade external antenna
- RTCM 3.0 (GPS+Glonass) and 3.2 (GPS + Glonass + Galileo + BeiDou) corrections services
- Open sky, under tree canopy and around buildings areas.

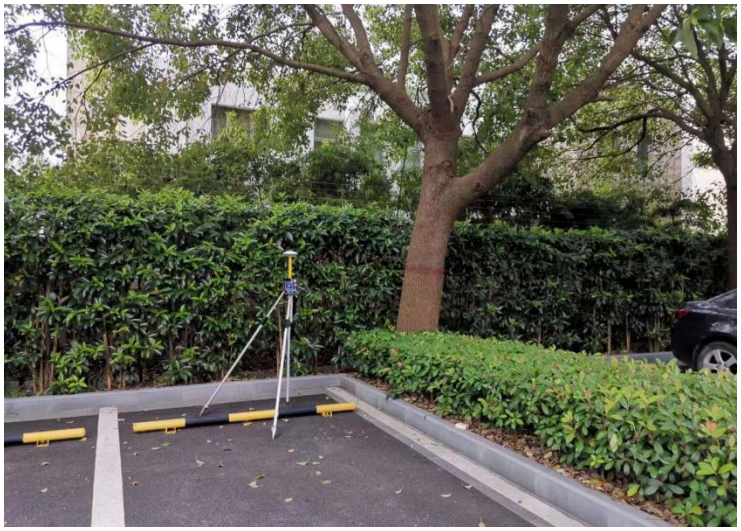
2. 2D Horizontal RTK accuracy

2.1. Field tests

The test site represents a realistic suburban environment with trees and buildings. It reflects the field working conditions of a wide range of users. The site is an offices park with opened areas next to buildings with numerous parking lots. The test results presented in this white paper show the typical unbiased accuracy achieved on the following test points:

Point 1 - Open Sky

Point 2- Close to high buildings



Point 3 - Under Tree canopy

2.2. Test methodology

To evaluate the absolute accuracy of LT700H:

- Each control point coordinates have been surveyed within 1 cm accuracy using the latest CHCNAV i90 Pro GNSS RTK receiver connected to a full GNSS RTK corrections. A series of measurements with epochs averaging and re-initializations have been conducted for each control point to ensure the quality control process.

To evaluate the accuracy of the LT700H on controls points under various conditions: open sky, trees canopy and high buildings:

- Around 500 points were measured using CHCNAV LandStar 7 land survey software, recording continuous points in every second. The RTK correction formats were NTRIP VRS (virtual reference station) in RTCM 3.0 and RTCM 3.2.

To compare the coordinates between the control points and the LT700H measurements:

- The CHINA BEIJING 1954 3-DEGREE GAUSS-KRÜGER 120E coordinate system was applied.

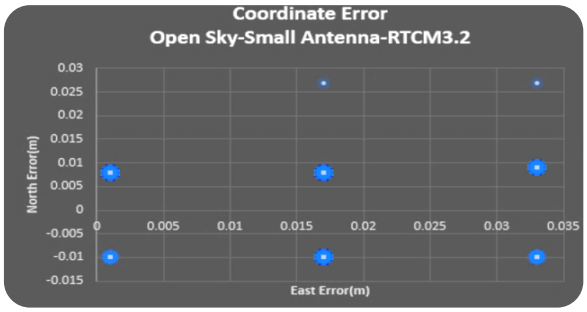
2.3. Data Analysis

2.3.1. Open sky environment

The LT700H demonstrates a consistent and reliable 2D accuracy of 5 cm under open sky conditions. The convergence time to reach a centimeter RTK fix solution is typically within 30 seconds independently from the measurement configuration (compact helix antenna, external geodetic antenna, RTCM 3.0 or RTCM 3.2.)

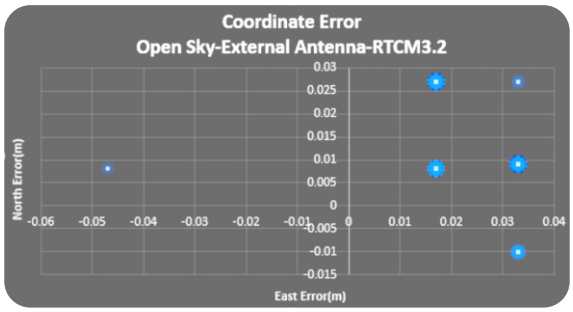
RTCM 3.2 | GPS+GLONASS+GALILEO+BEIDOU

Helix Compact Antenna



Standard deviation	0.009 m
Minimum error	0.008 m
Maximum error	0.034 m
Mean error	0.020 m

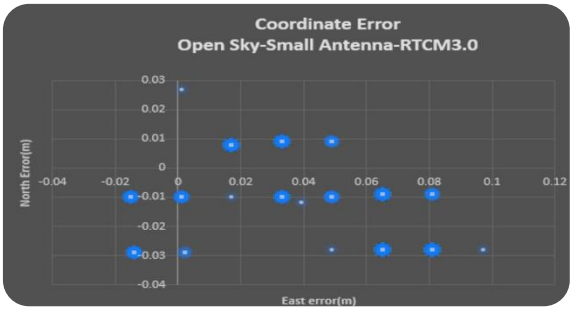
External Geodetic Antenna



Standard deviation	0.005 m
Minimum error	0.019 m
Maximum error	0.034 m
Mean error	0.032 m

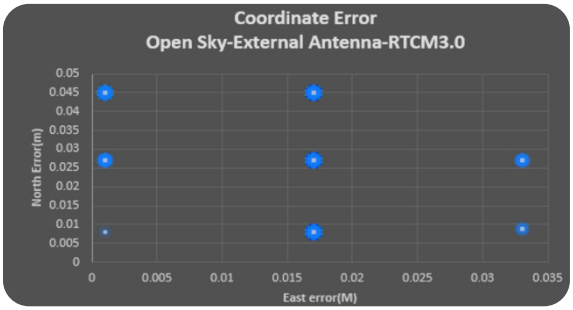
RTCM 3.0 | GPS+GLONASS

Helix Compact Antenna



Standard deviation	0.025 m
Minimum error	0.010 m
Maximum error	0.101 m
Mean error	0.047 m

External Geodetic Antenna



Standard deviation	0.012 m
Minimum error	0.019 m
Maximum error	0.048 m
Mean error	0.033 m

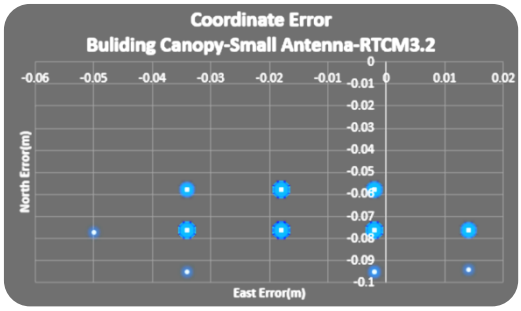
The use of full GNSS RTCM3.2. optimizes the positioning performances of the LT700H by approximately 1 cm. However, the use of an external geodetic antenna does not provide significant performance enhancement under open sky conditions.

2.3.2. High building environment

When starting up the LT700H very close to high buildings blocking the reception of the GNSS signals, the positioning accuracy will reach a decimeter float solution within 30 seconds, the convergence time to achieve centimeter accuracy will increase to a few minutes. To get the best productivity in such masked environment, standard GNSS survey practice shall be followed by the user i.e. moving away to an open sky to reach a centimeter fixed RTK position and then moving back to the constraint environment to perform the data collection. The LT700H robust GNSS signals tracking feature will maintain the centimeter accuracy

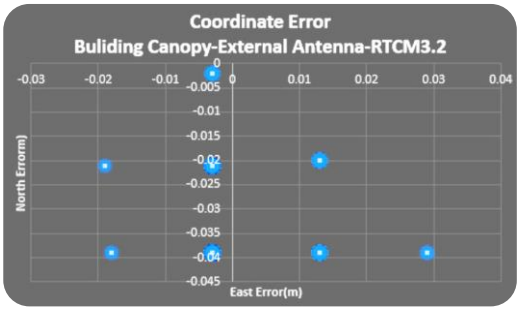
RTCM 3.2 | GPS+GLONASS+GALILEO+BEIDOU

Helix Compact Antenna



Standard deviation	0.009 m
Minimum error	0.061 m
Maximum error	0.096 m
Mean error	0.074 m

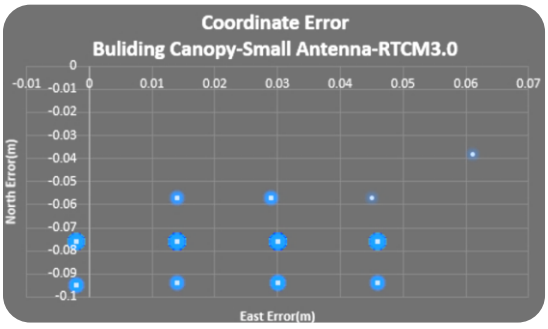
External Geodetic Antenna



Standard deviation	0.011 m
Minimum error	0.004 m
Maximum error	0.043 m
Mean error	0.030 m

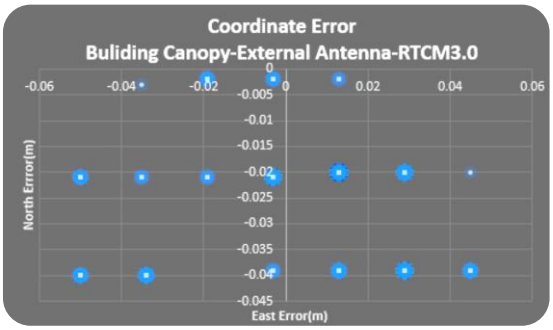
RTCM 3.0 | GPS+GLONASS

Helix Compact Antenna



Standard deviation	0.008 m
Minimum error	0.059 m
Maximum error	0.105 m
Mean error	0.082 m

External Geodetic Antenna



Standard deviation	0.015 m
Minimum error	0.004 m
Maximum error	0.064 m
Mean error	0.034 m

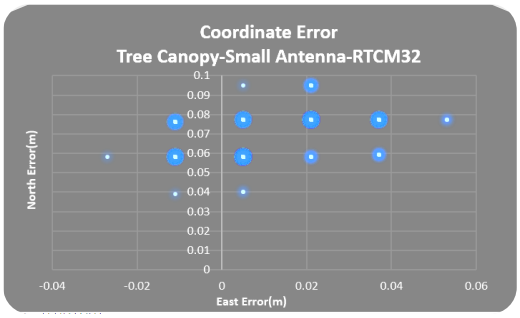
Standard GNSS survey practices combined with the LT700H robust GNSS signal tracking allows centimeter accuracy positioning in harsh environments. The use of full GNSS RTCM3.2. optimizes the positioning performances of the LT700H by approximately 1 cm. The use of an external geodetic antenna enhances the accuracy in obstructed sky area subject to high GNSS signal multipaths. The compact helix antenna maintains a sub-decimeter accuracy which is commonly required in precision GIS applications.

2.3.3. Dense tree canopy environment

The LT700H under dense tree canopy affecting the reception of the GNSS signals provides a decimeter positioning accuracy within 30 cm. By following best standard GNSS survey practice as described in 2.3.2 and depending foliage density, users can expect to collect data within 10 cm accuracy thanks to the LT700H robust GNSS signals tracking.

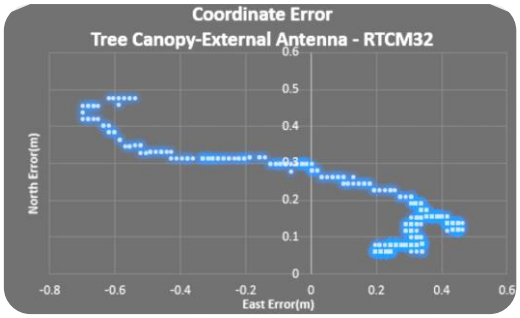
RTCM 3.2 | GPS+GLONASS+GALILEO+BEIDOU

Helix Compact Antenna



Standard deviation	0.012 m
Minimum error	0.097 m
Maximum error	0.058 m
Mean error	0.073 m

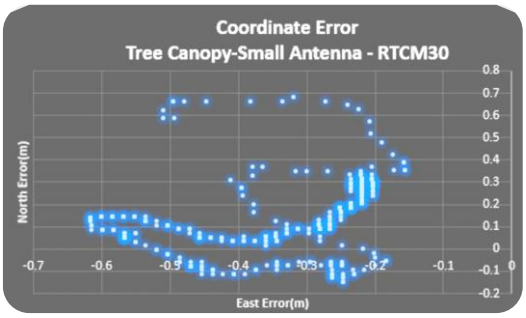
External Geodetic Antenna



Standard deviation	0.013 m
Minimum error	0.200 m
Maximum error	0.835 m
Mean error	0.336 m

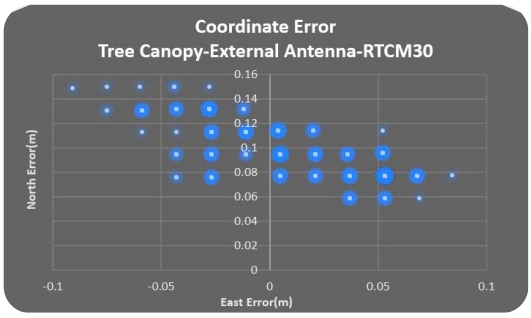
RTCM 3.0 | GPS+GLONASS

Helix Compact Antenna



Standard deviation	0.113 m
Minimum error	0.192 m
Maximum error	0.827 m
Mean error	0.398 m

External Geodetic Antenna



Standard deviation	0.031 m
Minimum error	0.144 m
Maximum error	0.070 m
Mean error	0.104 m

Standard GNSS survey practices combined with the LT700H robust GNSS signal tracking allows decimeter accuracy positioning under tree canopy. The various test configurations (helix antenna, geodetic antenna, RTCM3.0 and RTCM3.2) are showing rather similar results in such environment where a GNSS float solution is computed. The choice of the LT700H with its compact helix antenna provides higher portability.

3. 2D Horizontal Autonomous accuracy

Although the LT700H has been designed to fully optimized its performances as a GNSS RTK tablet connected to RTK networks services, the following tests were conducted to assess its accuracy and precision when working as a GNSS standalone tablet with the compact helix antenna.

STANDALONE GPS+GLONASS+GALILEO+BEIDOU			
	Open sky	**High building**	**Tree canopy**
Standard deviation	0.046 m	0.298 m	0.217 m
Minimum error	0.760 m	1.277 m	0.121 m
Maximum error	0.950 m	2.285 m	0.909 m
Mean error	0.829 m	1.756 m	0.610 m

The results are showing consistent submeter accuracy with good repeatability/precision of the measurements under open sky and under tree canopy environment. The standalone accuracy when working close to high buildings with high multipaths and mask is within 2 meters and shall be improved using an external geodetic antenna.

4. Conclusion

The series of tests conducted in October 2019 to assess the LT700H RTK Android Tablet confirms that its centimeter to decimeter accuracy GNSS positioning performances, both in accuracy and repeatability, are perfectly matching the requirements of precision GIS data collection.

The LT700H also provides an effective and highly portable GNSS solution for construction site layout, underground pipes mapping, forensic surveying … without the need to utilize traditional GNSS RTK Smart receivers.

The LT700H GPS+Glonass+Galileo+BeiDou GNSS algorithm provides consistent, accurate and precise positioning in the commonly faced environments. The use of RTCM3.2 corrections services optimizes its performances.

The high quality, compact GNSS helix antenna bundled with the LT700H offers robust GNSS signal tracking suitable in most application. The addition of an external geodetic GNSS antenna increase the accuracy under difficult multipath environment such as high buildings.

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