Report on GNSS Training
Course ID: T151-40

Team No: 5

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1. Executive Summary

The objectives of this work are to assess performances of low-cost receivers for high accuracy positioning with focusing on two GNSS methods i.e., static and dynamic. GNSS data was observed using low-cost instruments i.e., M8T (single frequency), F9P (dual frequency) and high-end instruments i.e., netR9 at the area of AIT campus. Both static and dynamic positioning were considered. In doing this, the configuration of receiver was made using U-Center version 19.11.01. Our data was processed using RTKLIB v.2.4.3 b33 and was analyzed in three positioning methods which are SPP, DGNSS/DGPS, and Kinematic (RTK). In our work, for SPP, it was found that the M8P shows better performance than netR9, as indicated by spherical error probable (SEP), one of the wildly used 3D position accuracy measure. The possible reason could be a larger number of data record.

1.1. Team Members

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1.2. INTRODUCTION

In present, GNSS-based application has gained more attention. There are different receivers widely used in the world. In this work, we employed low-cost receivers for high accuracy positioning for the performance evaluation, particularly for M8T (single frequency), F9P (dual frequency) and high-end instruments i.e., netR9. Both static and dynamic positioning were considered with three positioning methods i.e., SPP, DGNSS/DGPS, and Kinematic (RTK) were processed. There are 3 sections consisting of setting up field survey and data processing which were explained as follows:

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Figure 1.1 Observation Site (Red Square)

1.3. SETTING UP

Before using the GNSS receiver of U-Blox (M8T or F9), we need to make a configuration with U-center program first. There are three steps to config as below:

1.3.1. GNSS (GNSS CONFIGURATION)

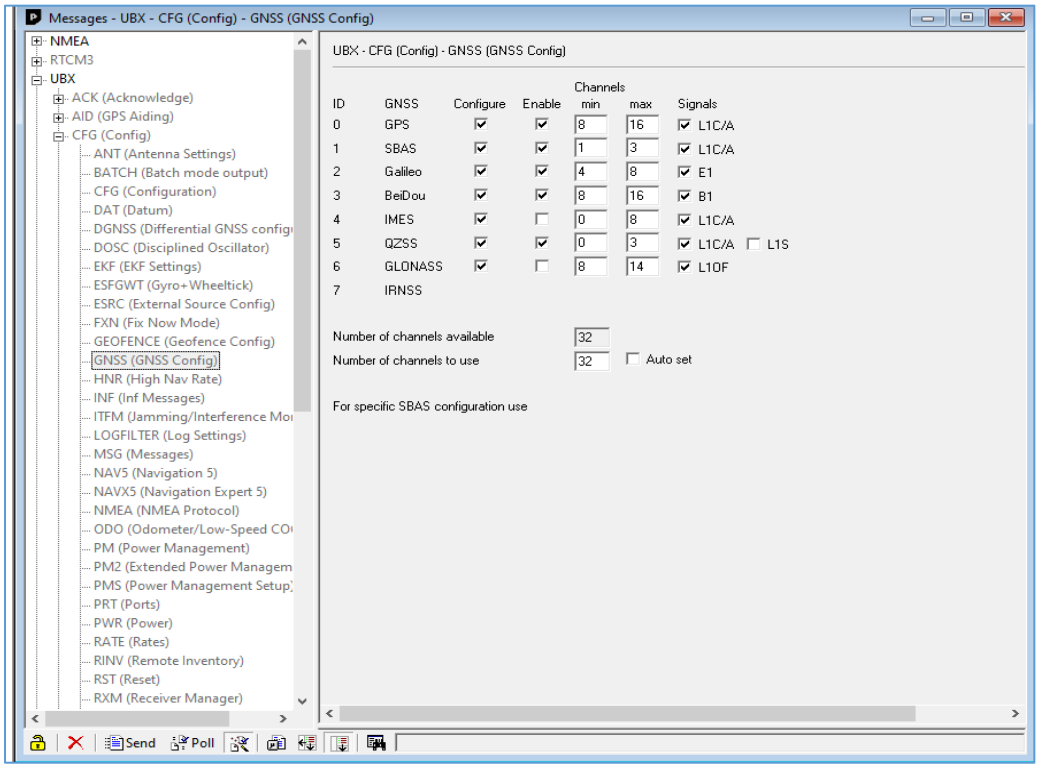


Figure 1.2 GNSS Configuration Setting Up

- Single frequency receiver: if BeiDou are enable for data collection, GLONASS are not and reverse.
- Dual frequency receiver: Both BeiDou and GLONASS can be enable at the same time to collect data.

1.3.2. PRT (PORTS) AND RATE (RATE)

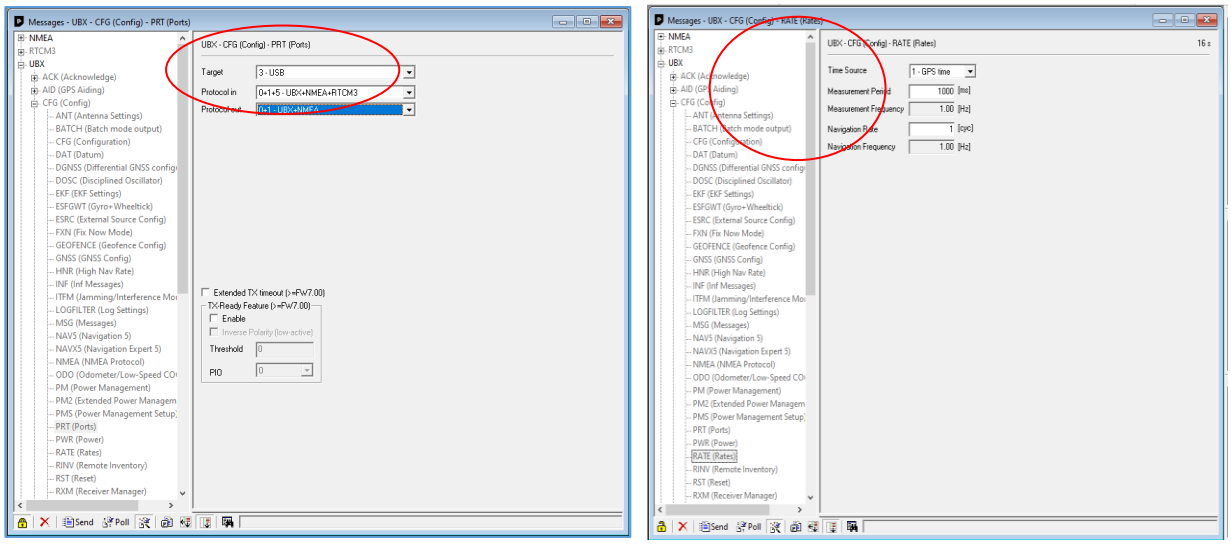


Figure 1.3 PRT (Ports) and RATE Setting Up

1.3.3. RXM (RECEIVER MANAGER)

We need to enable message of RAWX and SFRBX.

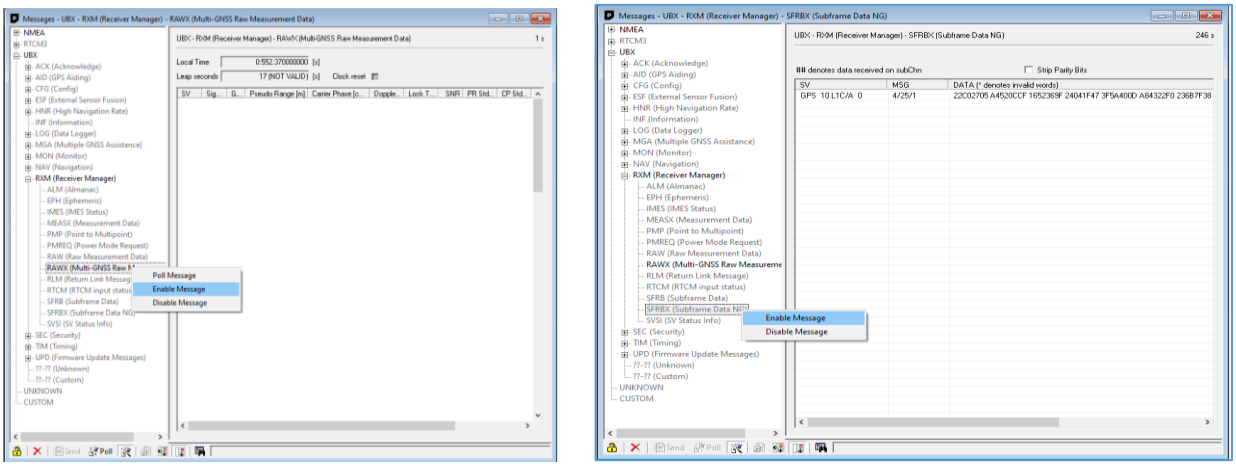


Figure 1.4 Message Setting Up

1.4. DAY 2: DATA COLLECTION AND OBSERVATION USING M8T

In this training, GPS observation data was collected using M8T receiver for static and dynamic positioning at the area within AIT.

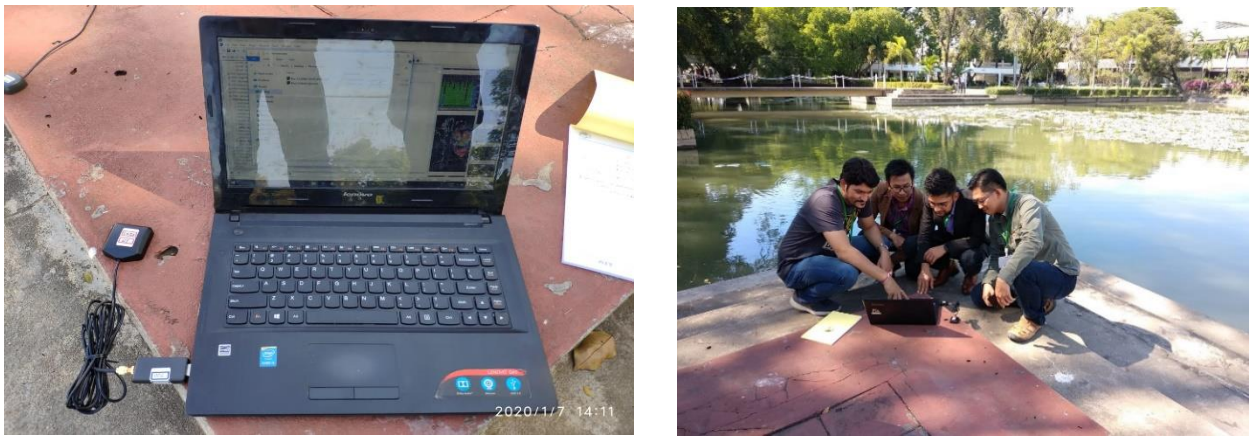
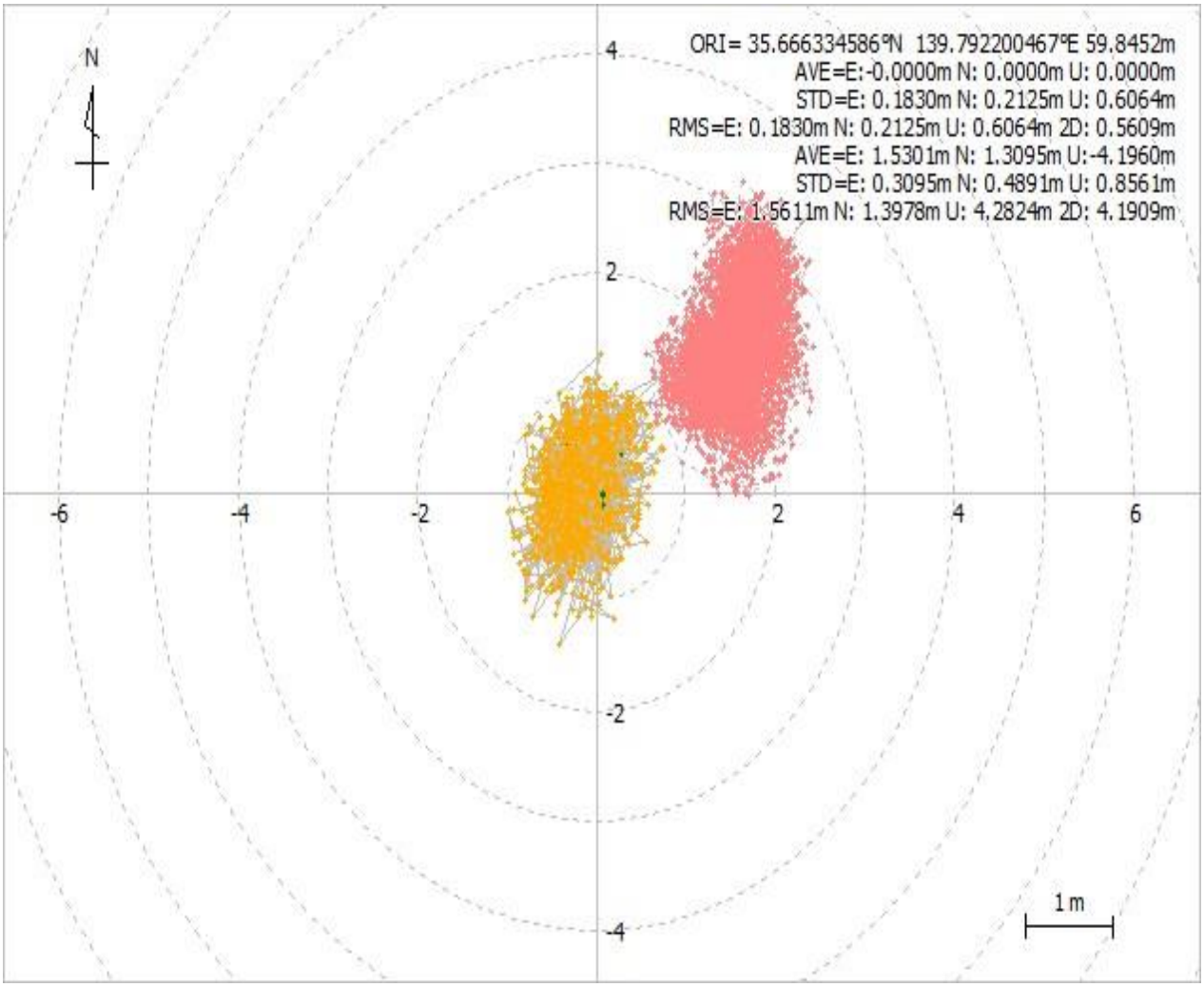


Figure 1.5 Stationary Point Positioning Using single Band Receiver(M8T)

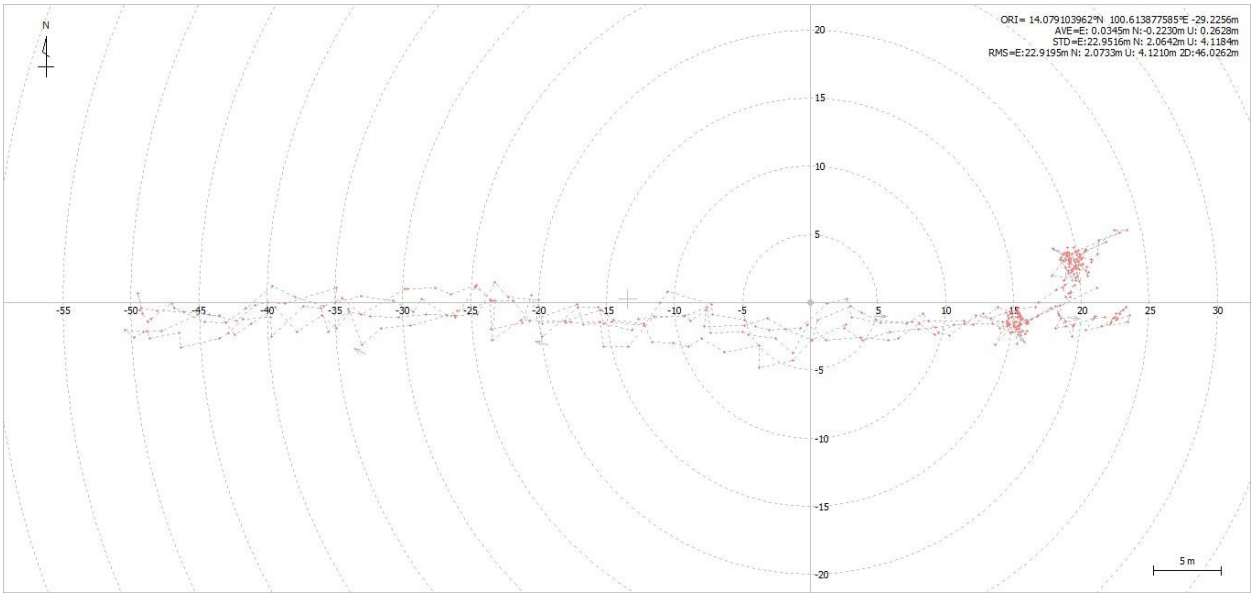
Figure 1.6 Data Overlay on Google Earth


N
ORI= 35.666334586°N 139.792200467°E 59.8452m
AVE=E:-0.0000m N: 0.0000m U: 0.0000m
STD=E: 0.1830m N: 0.2125m U: 0.6064m
RMS=E: 0.1830m N: 0.2125m U: 0.6064m 2D: 0.5609m
AVE=E: 1.5301m N: 1.3095m U:-4.1960m
STD=E: 0.3095m N: 0.4891m U: 0.8561m
RMS=E: 1.5611m N: 1.3978m U: 4.2824m 2D: 4.1909m
4
2
-2
-4
-6
-4
-2
2
4
6
1 m

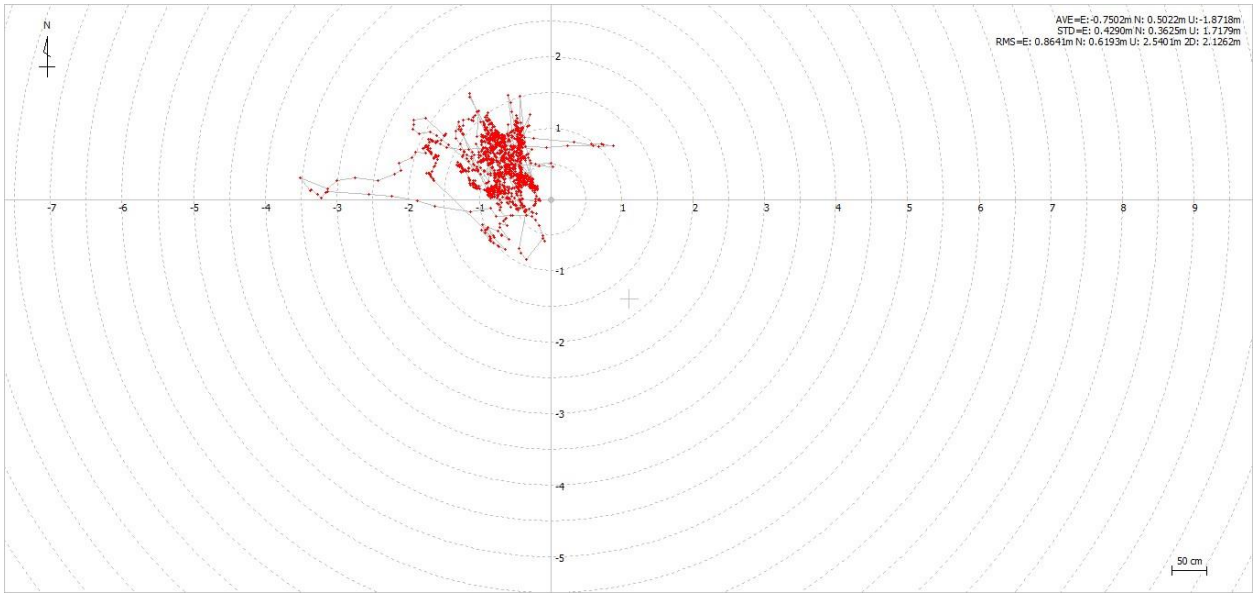
1.7 Figure: SPP using M8T Receiver

1.5. DAY3: COLLECTION AND PROCESSING OF STATIC AND DYNAMIC DATA USING F9P RECIEVER

1.8 Figure: Data Collection Using F9P receiver



1.9 Figure: PPK using F9P Receiver



1.10 Figure: SPP using F9P receiver

1.6. DAY4: PROCESSING OF ZERO BASELINE DATA

Table 1.1 Performance of different receivers in several positioning methods

Receiver	σ_x	σ_y	σ_z
NetR9-SPP	1.15666	0.63952	0.84944
M8T-SPP	0.89230	0.80211	0.83812
M8T-DGPS	0.08699	0.11731	0.12935
M8T-RTK	0.08092	0.09861	0.11479

Table 1.2 Performance of NETR9 and M8T Receiver for Static Positioning

Receiver	σ_x	σ_y	σ_z	SEP
NetR9	0.966136	0.68432	1.247988	1.478206
M8T	0.981317	0.780512	0.730523	1.2711

Remark: SEP (Spherical Error Probable) use the following equation $0.51(\sigma y + \sigma x + \sigma z)$

1.7. DAY5: RTK USING RTKDROID APP

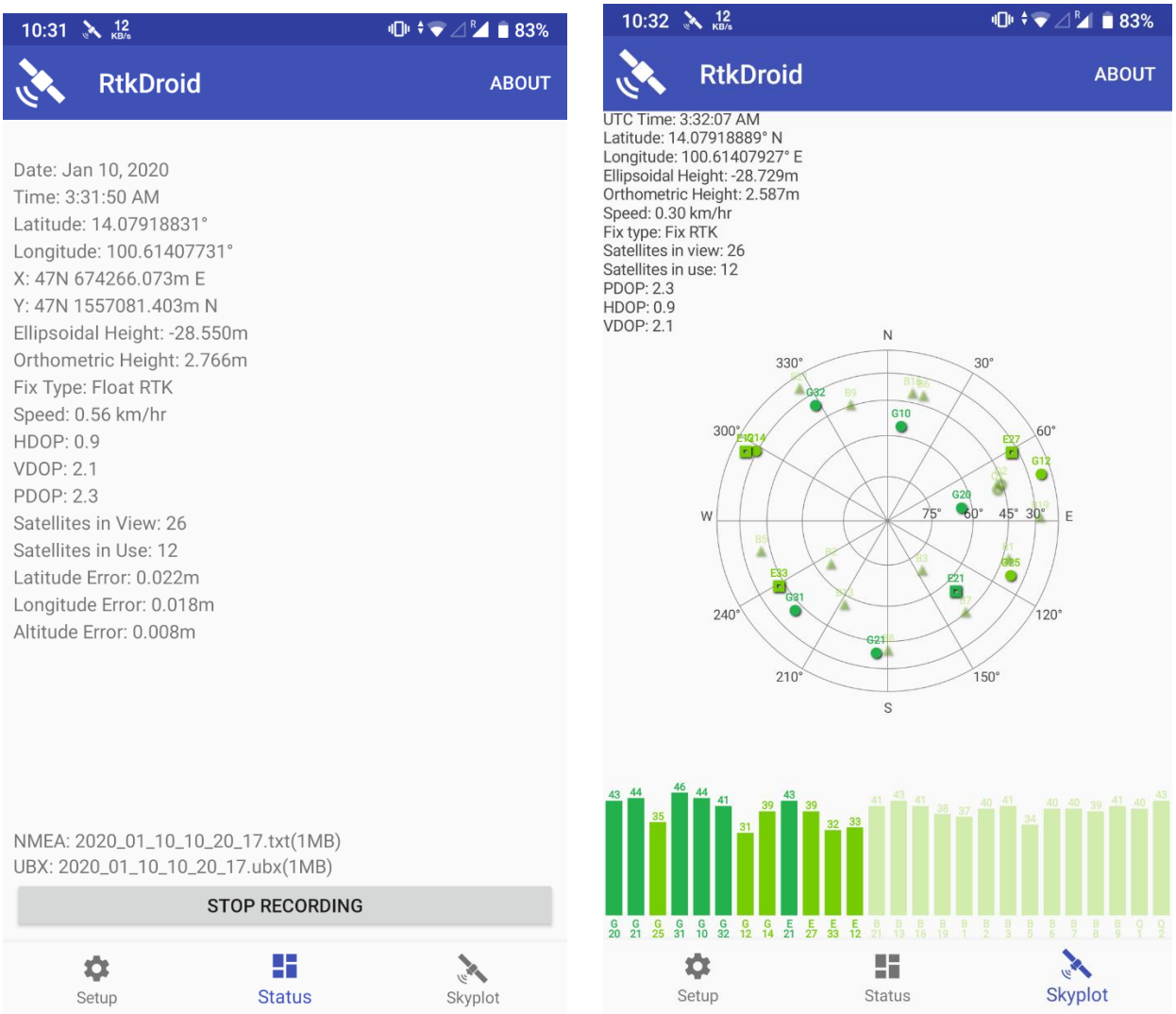


Figure 1.11 Recording with M8T receiver using RTKDROID

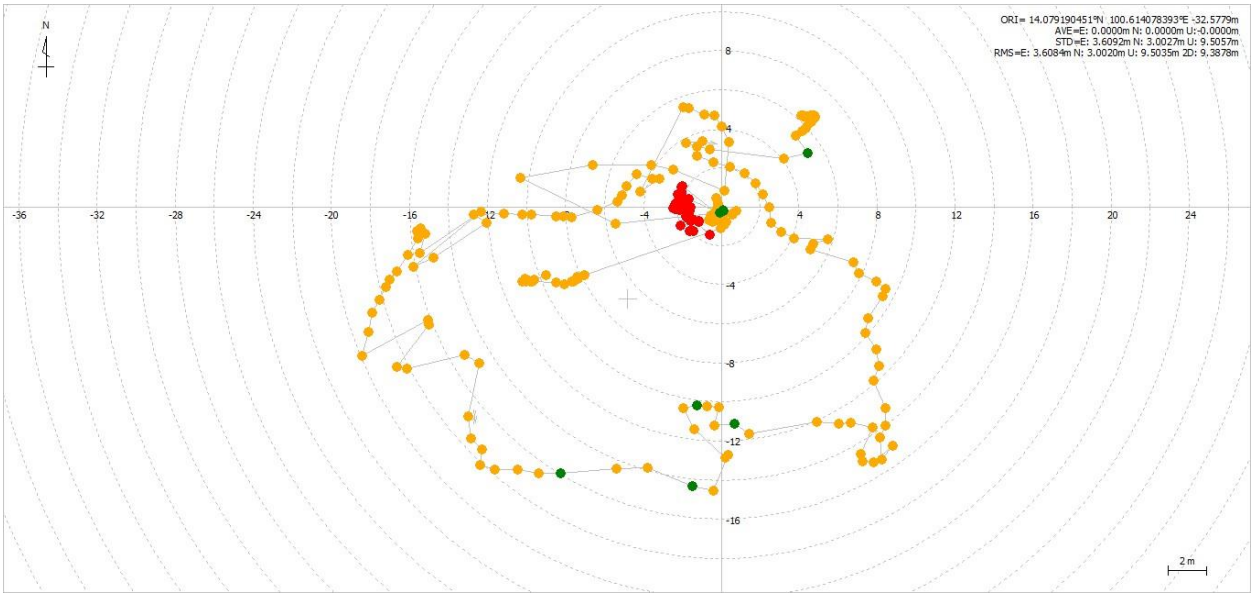


Figure 1.12 Skyplot of Collected Data

1.8. RECOMMENDATIONS

Dual frequency receivers are better, however better accuracy and precision using single frequency receiver can be obtained if the receiver is kept under open sky for sufficiently longer duration.