
Spoofing Test with CLAW GPS Simulator

December 1, 2023

Ellarizza Fredeluces
Tokyo University of Marine Science and Technology

Contents

- Android Device test
- uBlox M8T test
- PocketSDR test

Experiment Setup – Android Device

Live Signals from
Another Antenna



Novatel ProPak6

NAV DATA,
NMEA INPUT

1PPS INPUT

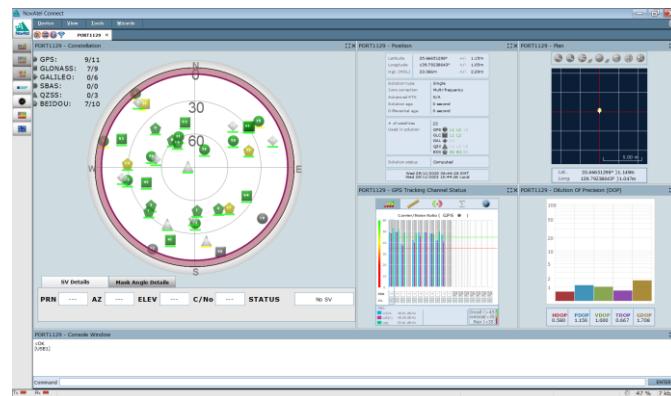


DC Block

CLAW GPS
Simulator



PC



Novatel Connect

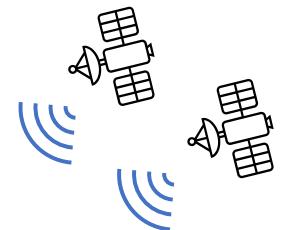


SimCon

Spoof Signal



Google Pixel 7a



Live Signal

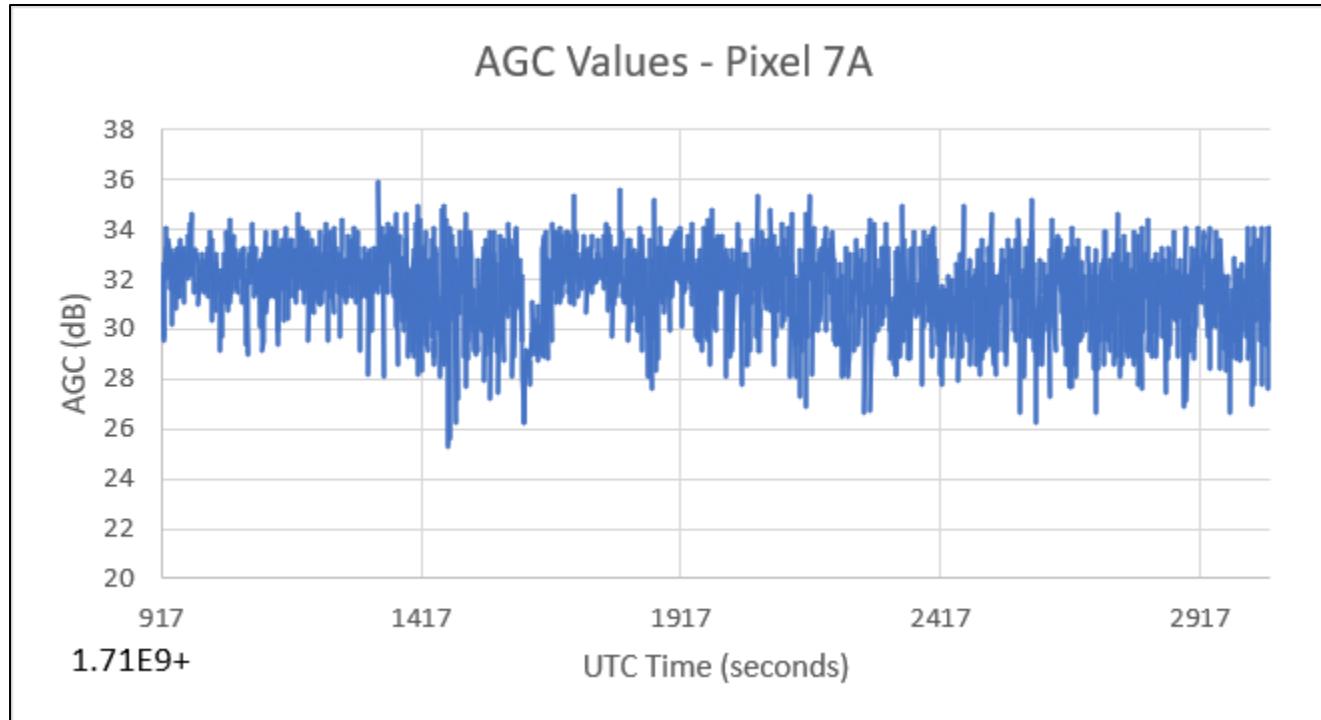
Log Raw and
NMEA data

Android Device Test

- I turned on the spoofer when the position was locked continuously for 2 minutes.
- The observation time was around 40 minutes. All satellite constellations were tracked for the whole time.

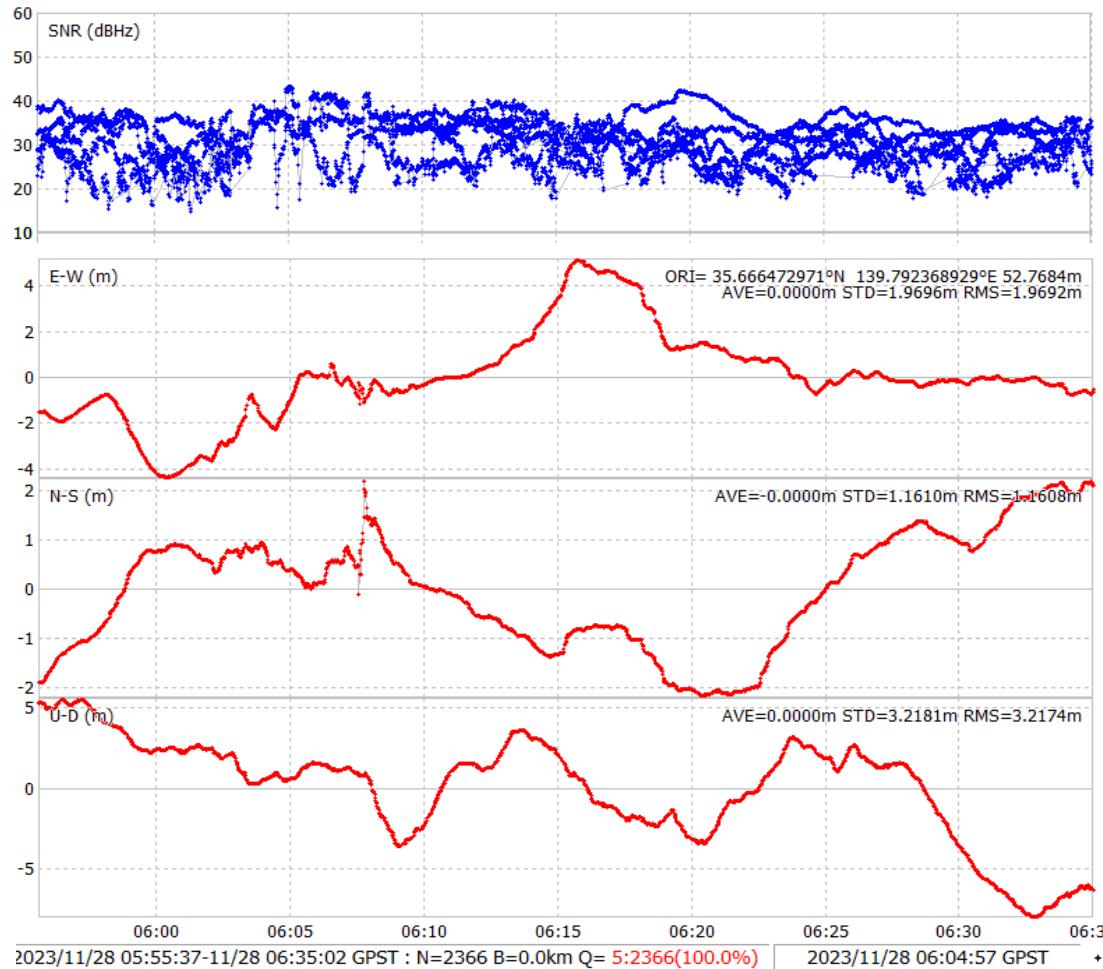
Android Device Test – Pixel 7a

AGC Values



No apparent abrupt change in values when the spoofer was turned on.

Android Device Test – Pixel 7a



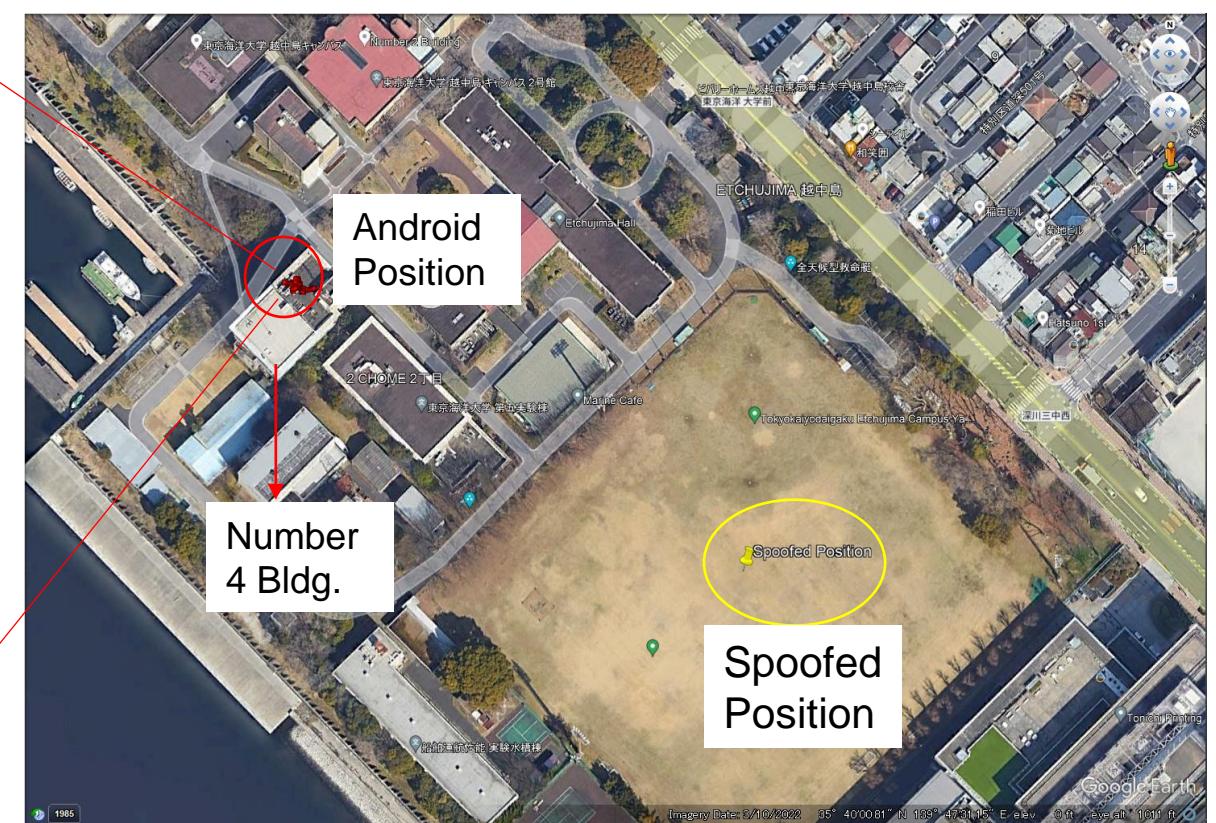
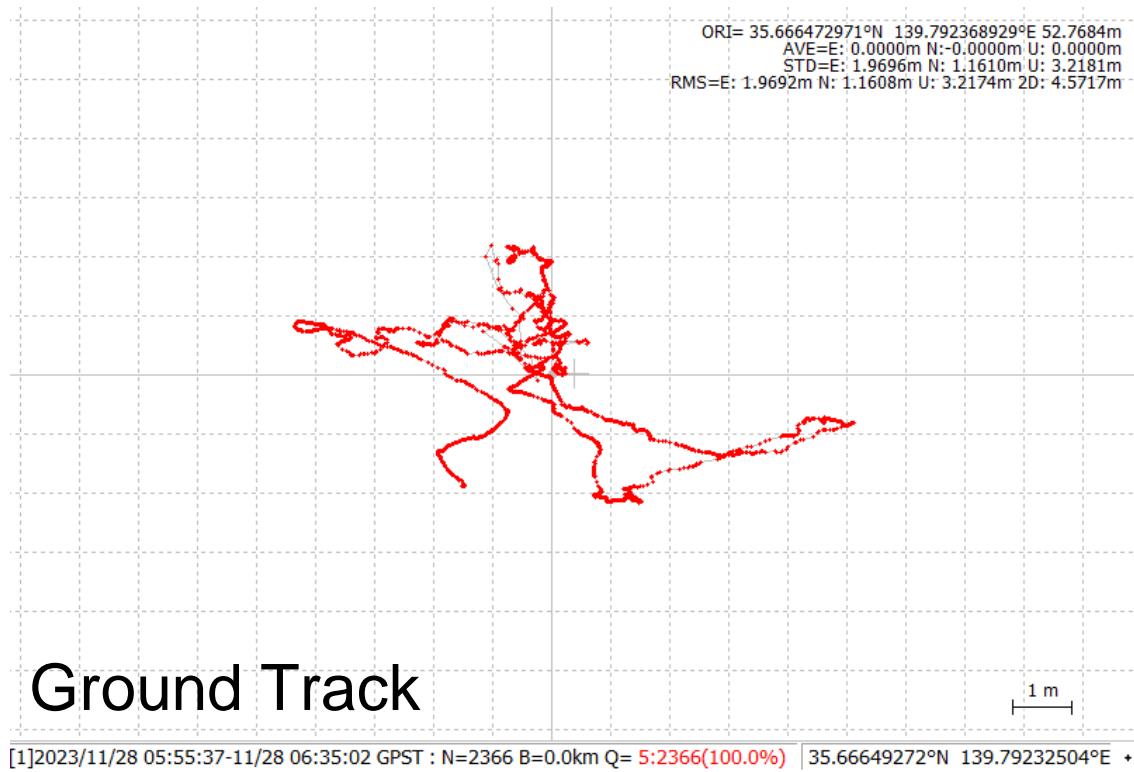
→ SNR Values of visible GPS Satellites

Observing SNR values, there is no time where all values from each satellite become almost the same. Positioning results also indicate results of smartphone position within +/- 5 meters.

Hence, Pixel 7a was not spoofed.

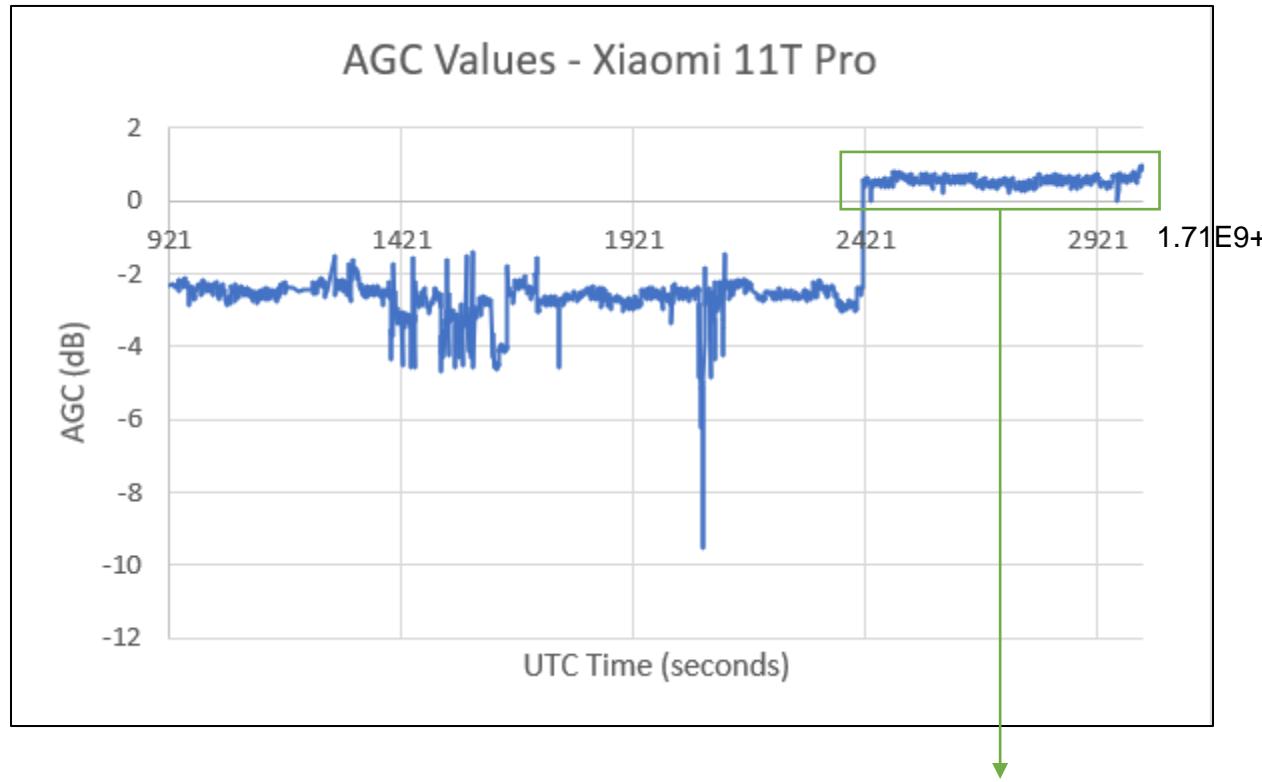
Android Device Test – Pixel 7a

Position Results



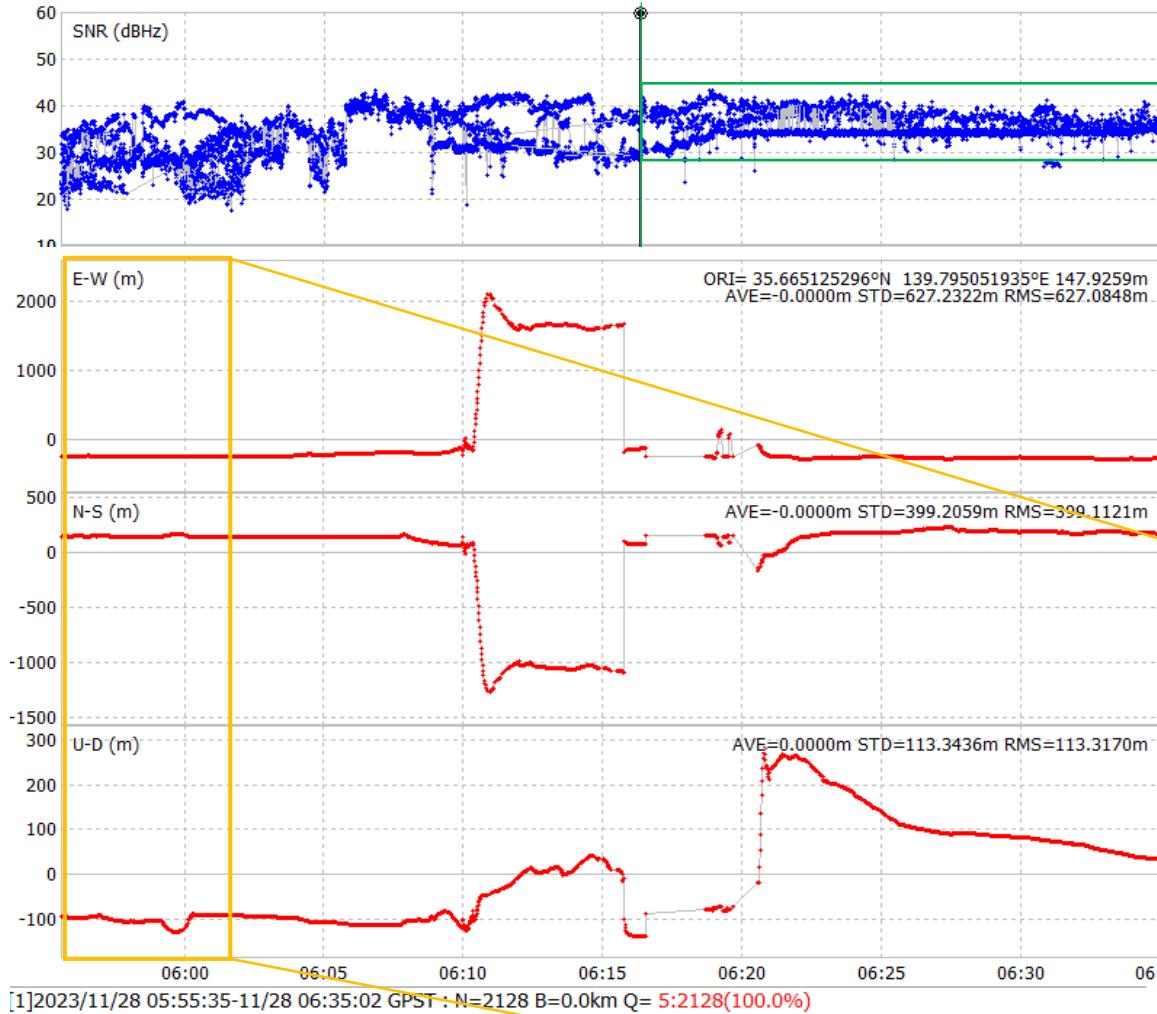
Android Device Test – Xiaomi 11T Pro

AGC Values



This abrupt change in AGC corresponds to a certain behavior of SNR values of GPS satellites as will be shown in the next figure.

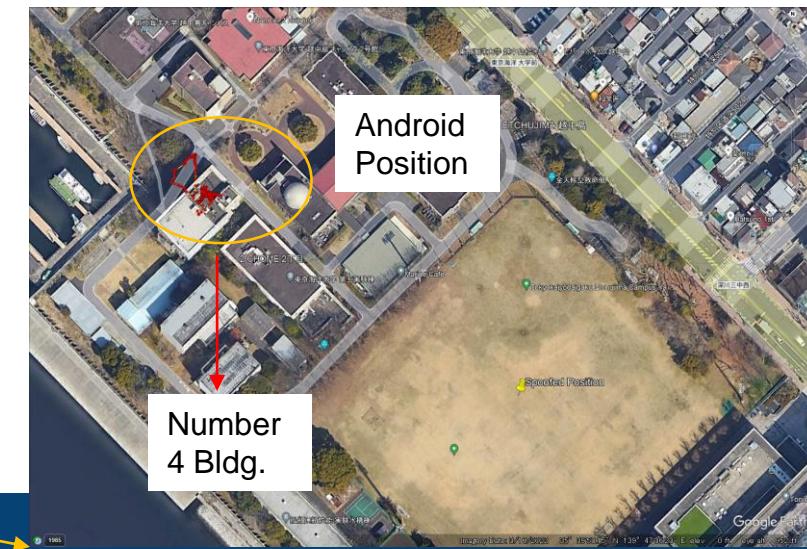
Android Device Test – Xiaomi 11T Pro



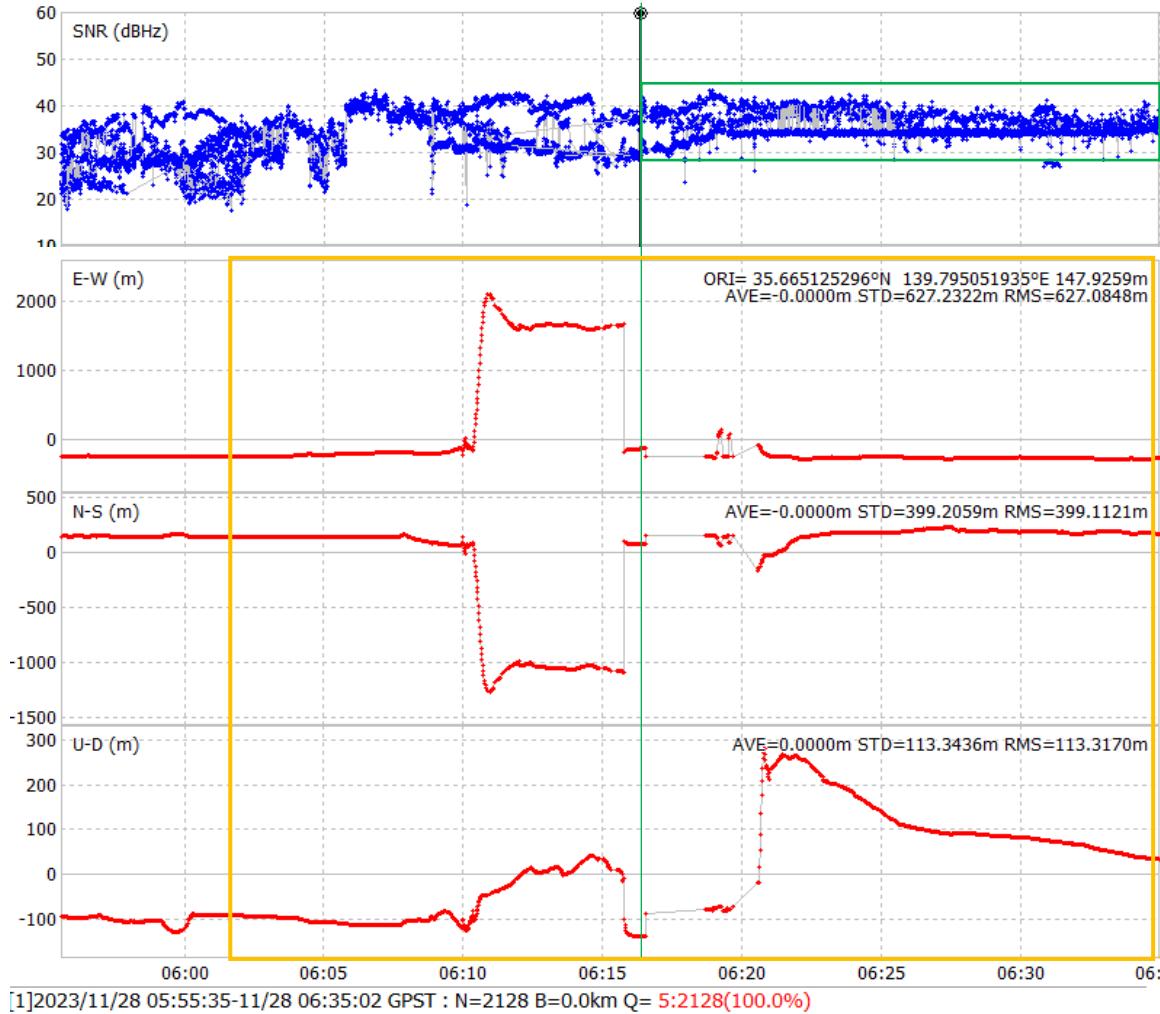
SNR Values of visible GPS Satellites

Around 06:16:21 (GPST), SNR values have become almost the same for all satellites until the end of observation.

In this part, computed positions are correct.



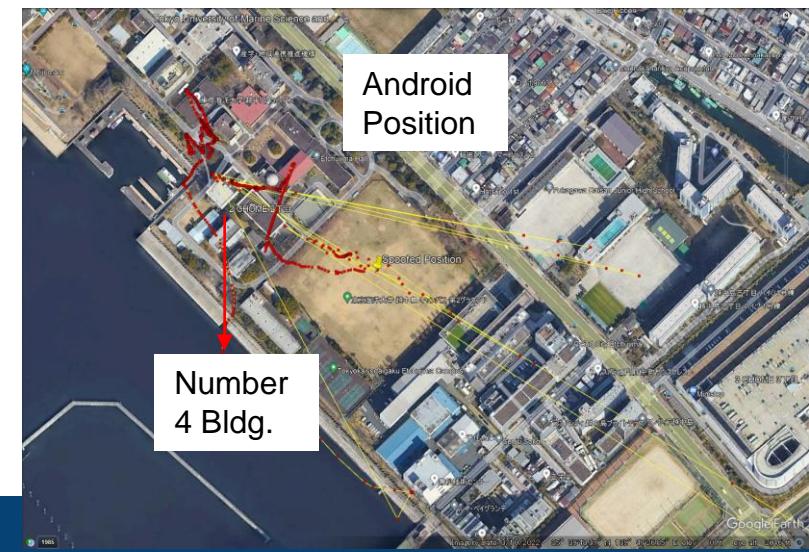
Android Device Test – Xiaomi 11T Pro



SNR Values of visible GPS Satellites

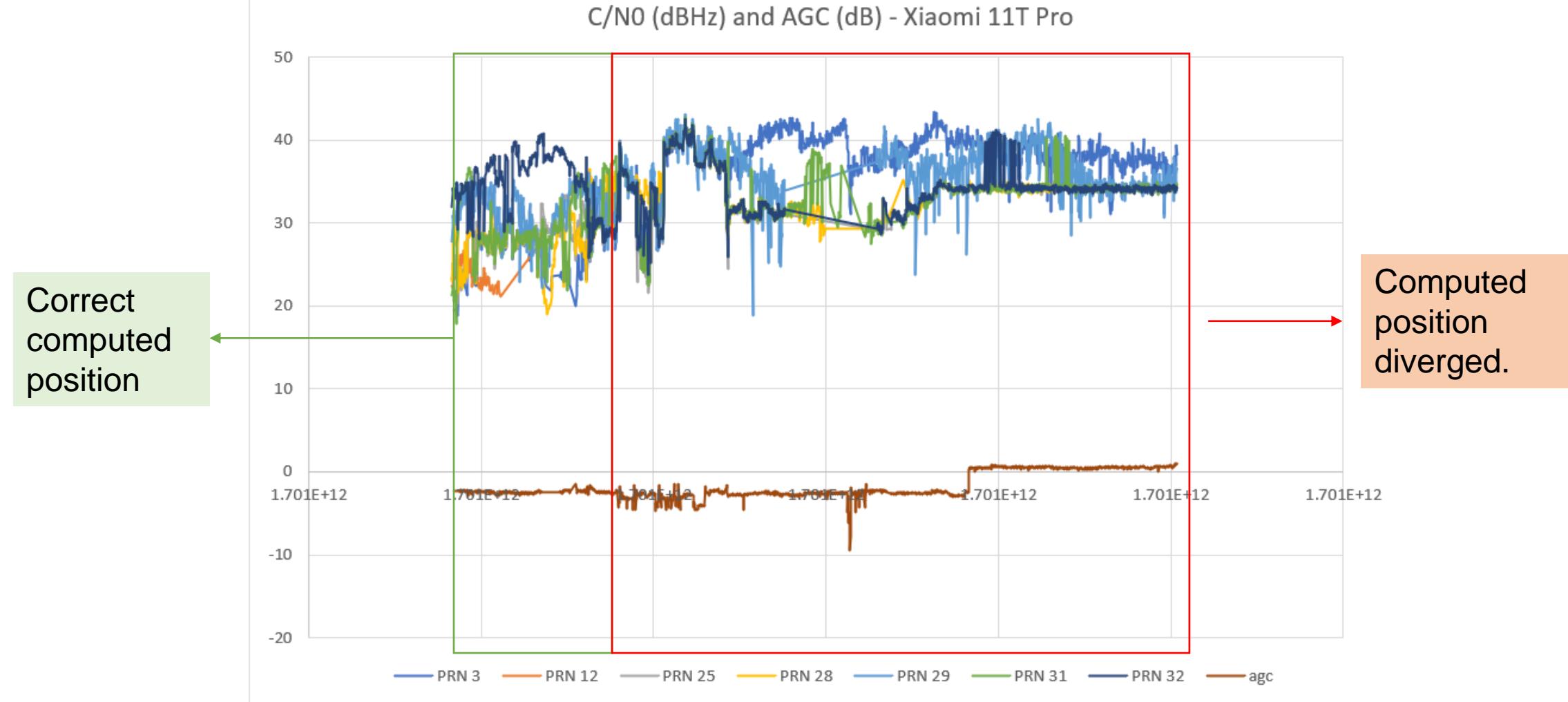
Around 06:16:21 (GPST), SNR values have become almost the same for all satellites until the end of observation.

This part shows that the computed position deviate largely from previous epochs.



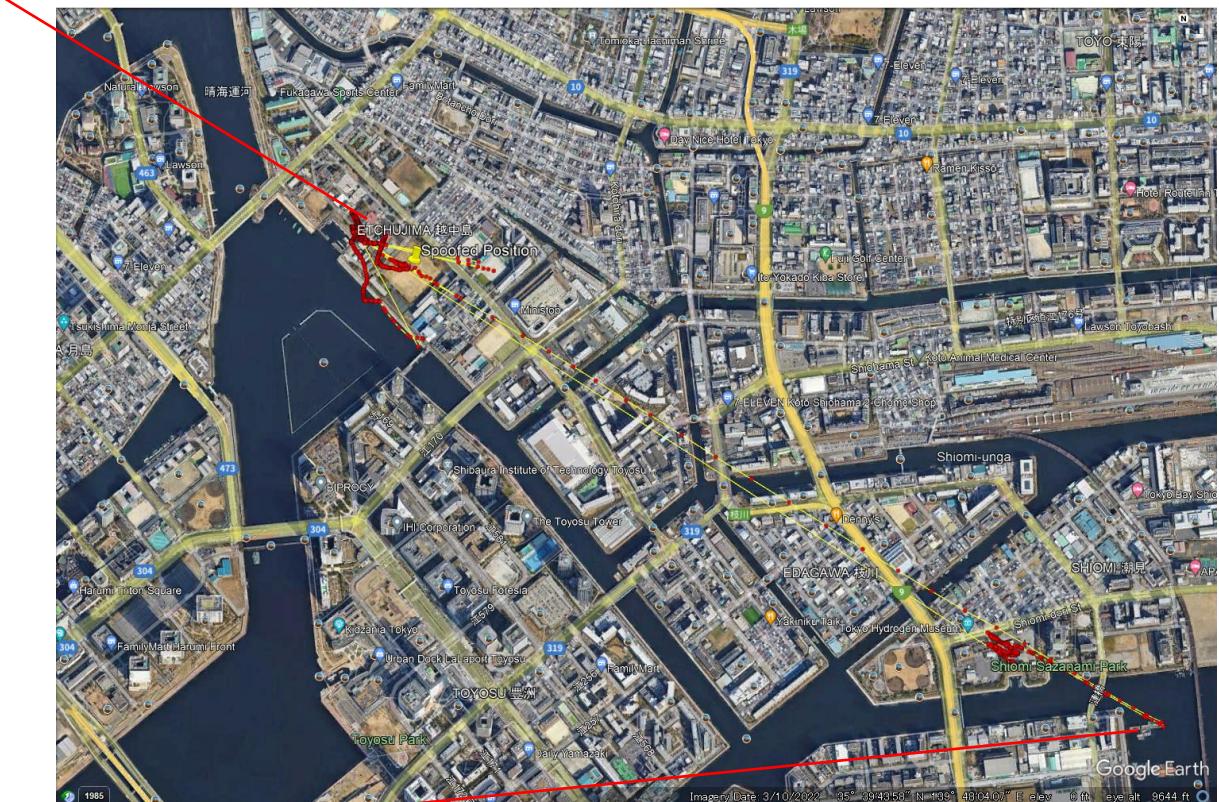
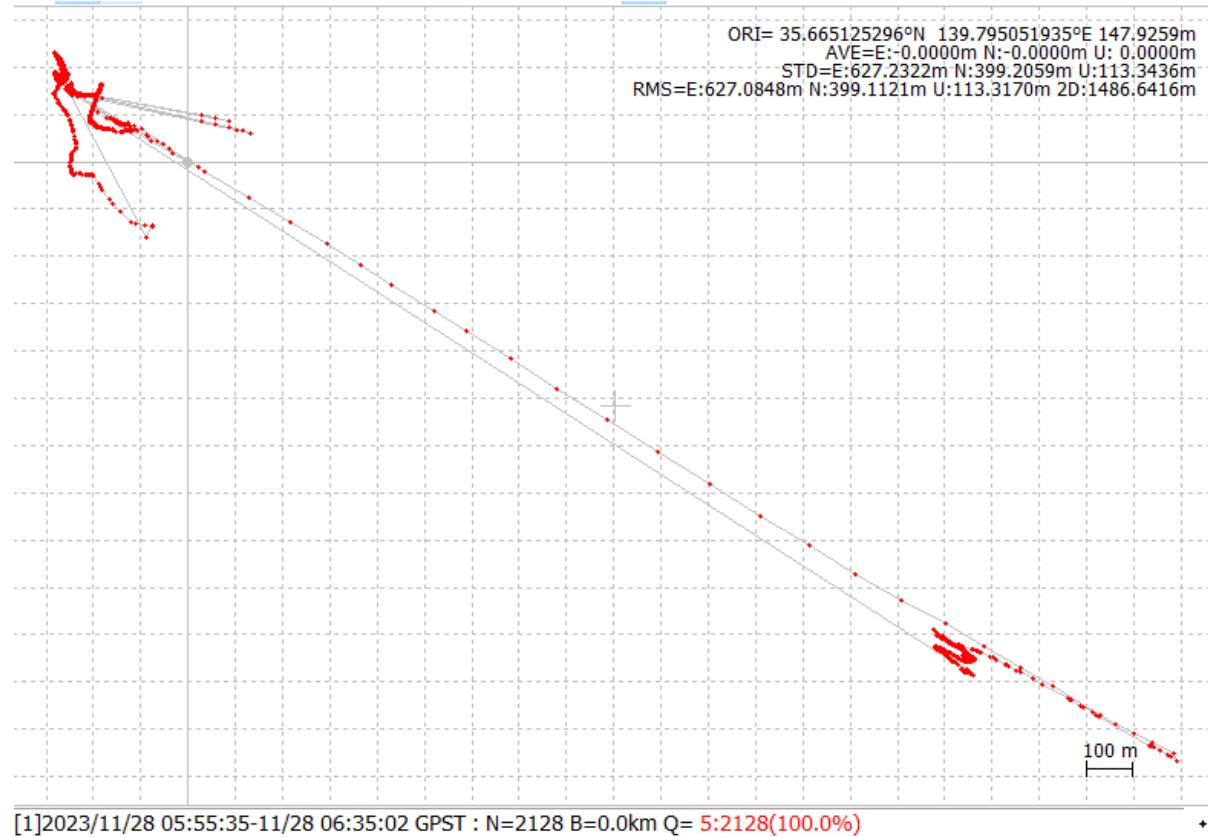
Android Device Test – Xiaomi 11T Pro

AGC and C/N0 Values from Raw



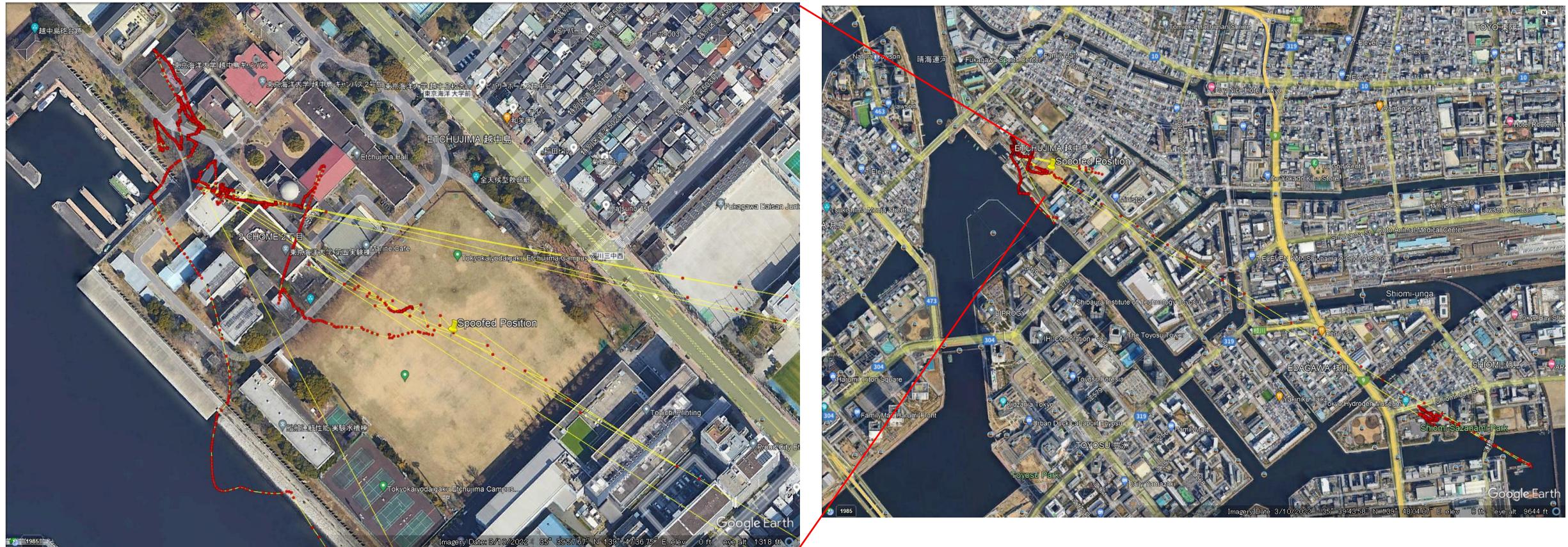
Android Device Test - Xiaomi 11T Pro

Position Results



Android Device Test - Xiaomi 11T Pro

Position Results



Experiment Setup – uBlox M8T

Live Signals from Another Antenna



Novatel ProPak6

LIVE NAV DATA,
NMEA INPUT

1PPS INPUT



DC Block

Spoof
Signals



30 dB Amplifier



uBlox M8T



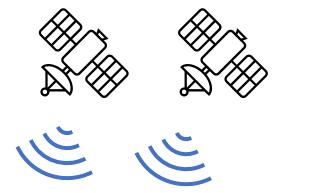
PC



Novatel Connect



SimCon



Antenna

Live Signals

Android Device Test

- I turned on the spoofer after 1 minute.
- Observation time was around 20 minutes.

uBlox M8T Test

SNR (dBHz)

G04 – 42

G16 – 47

G18 – 40

G26 – 47

G27 – 42

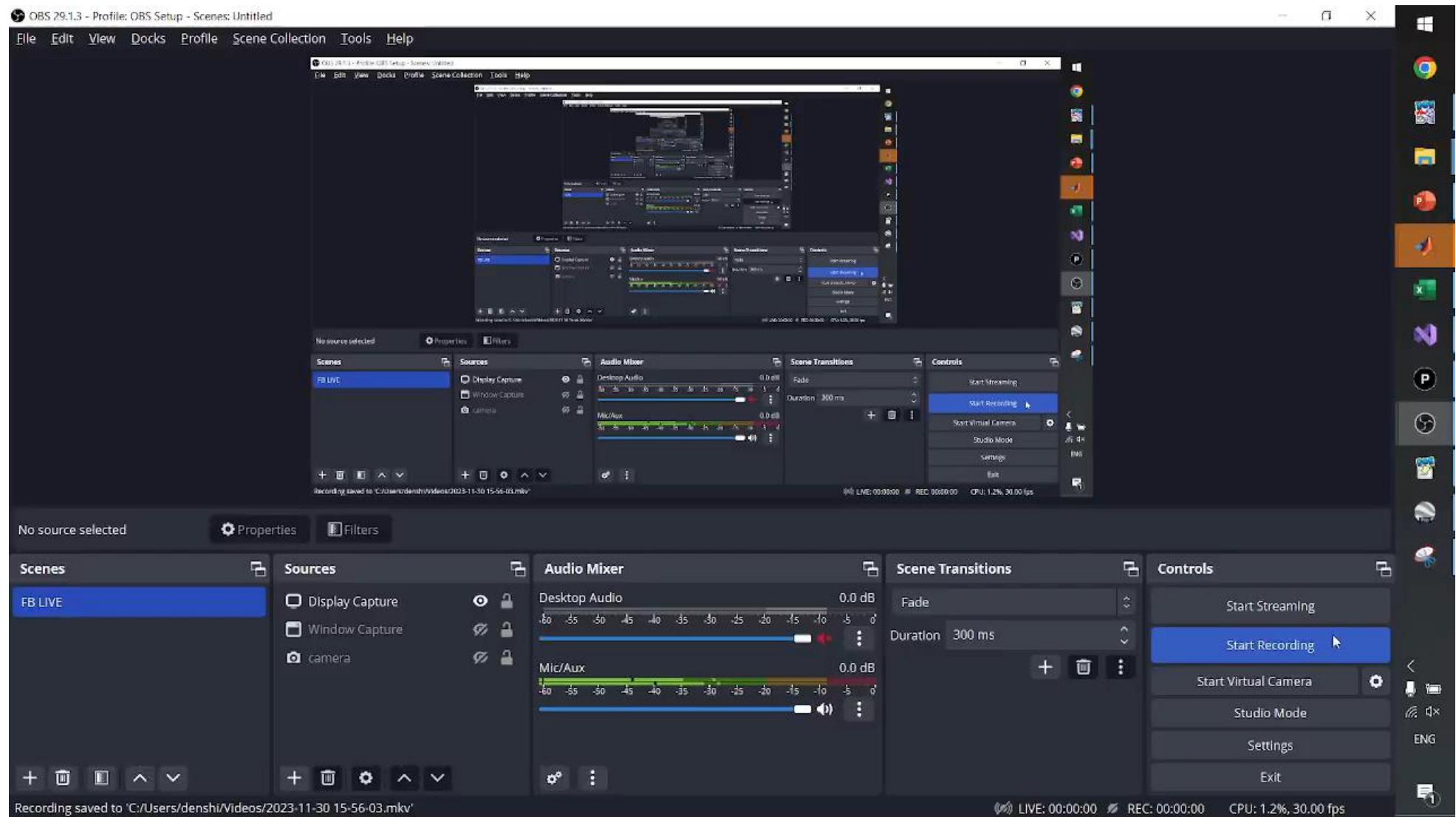
G28 – 46

G29 – 41

G31 – 47

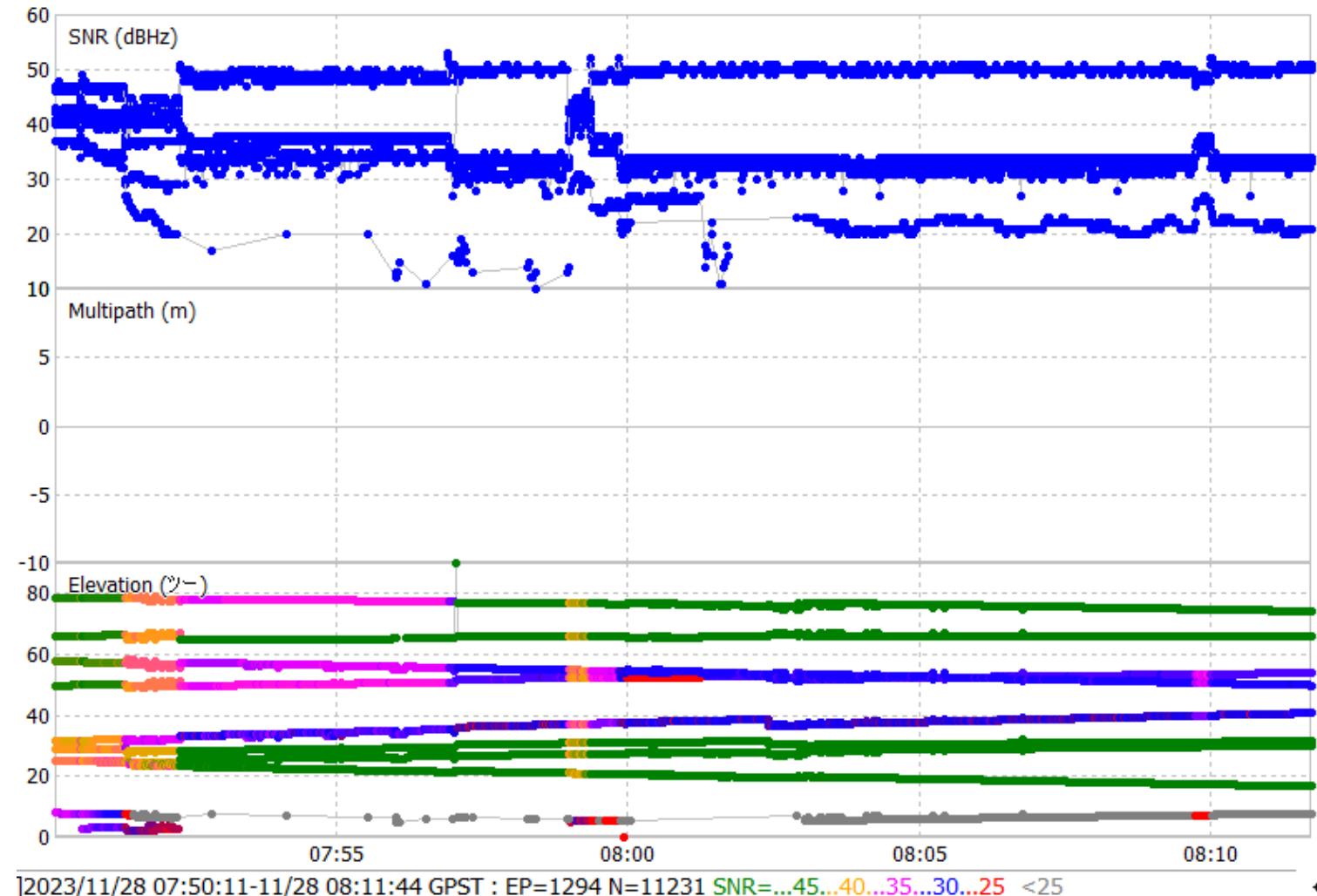
G09 – 36

G32 – 36



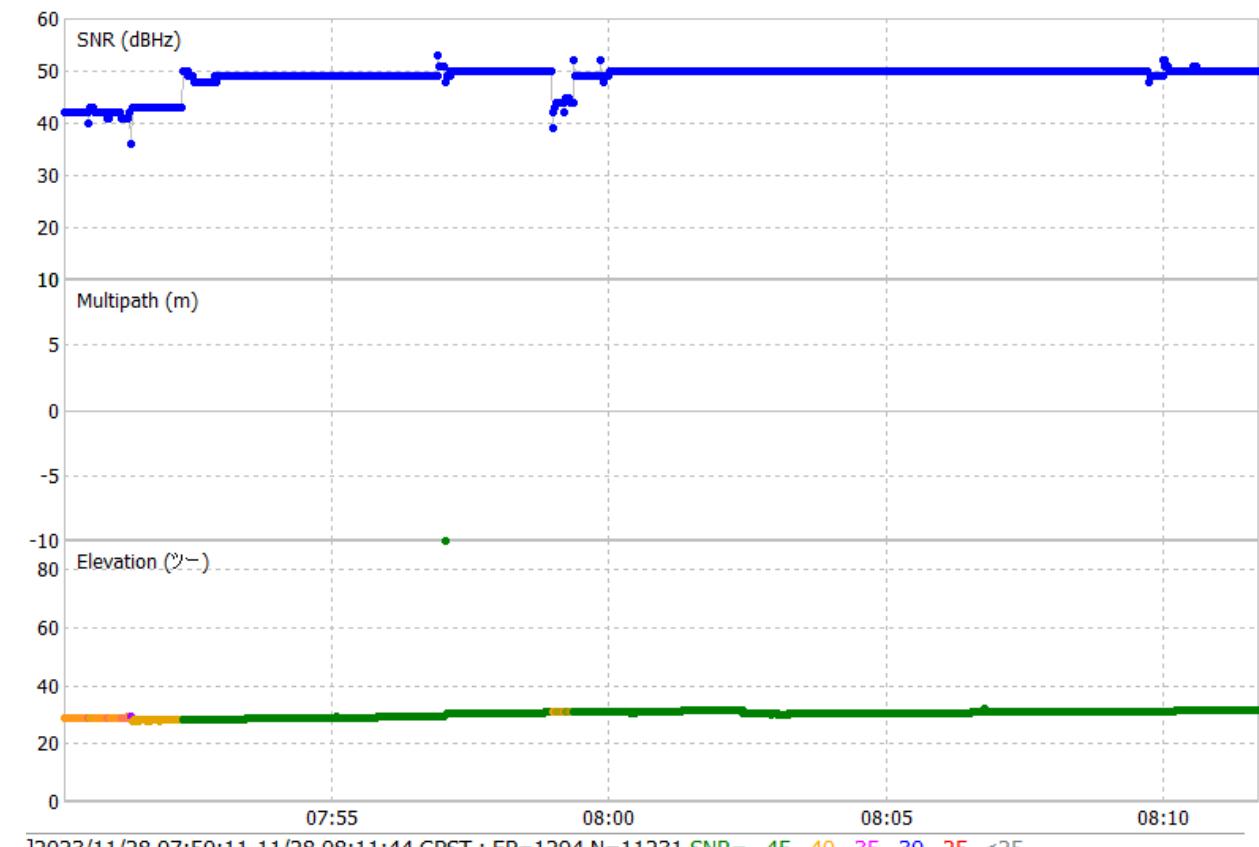
uBlox M8T Test

SNR Values



uBlox M8T Test

G04

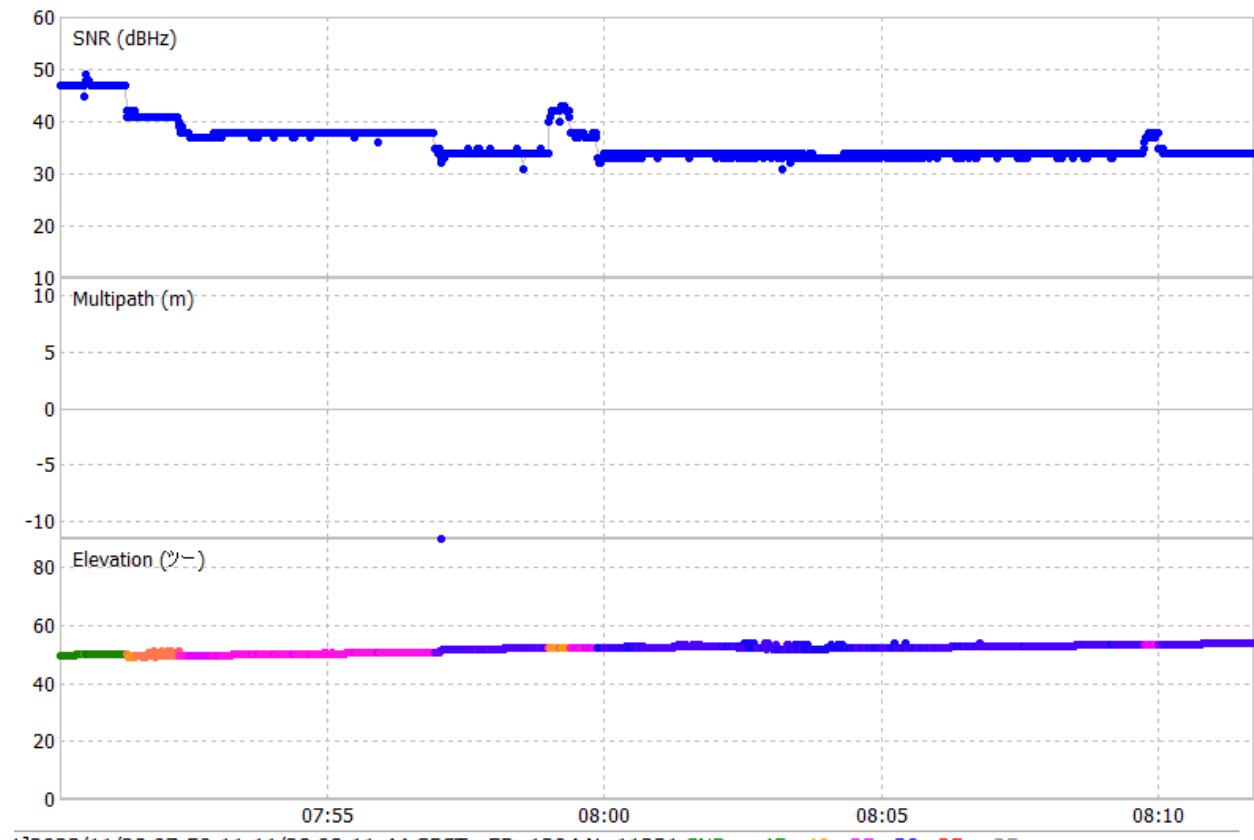


G09

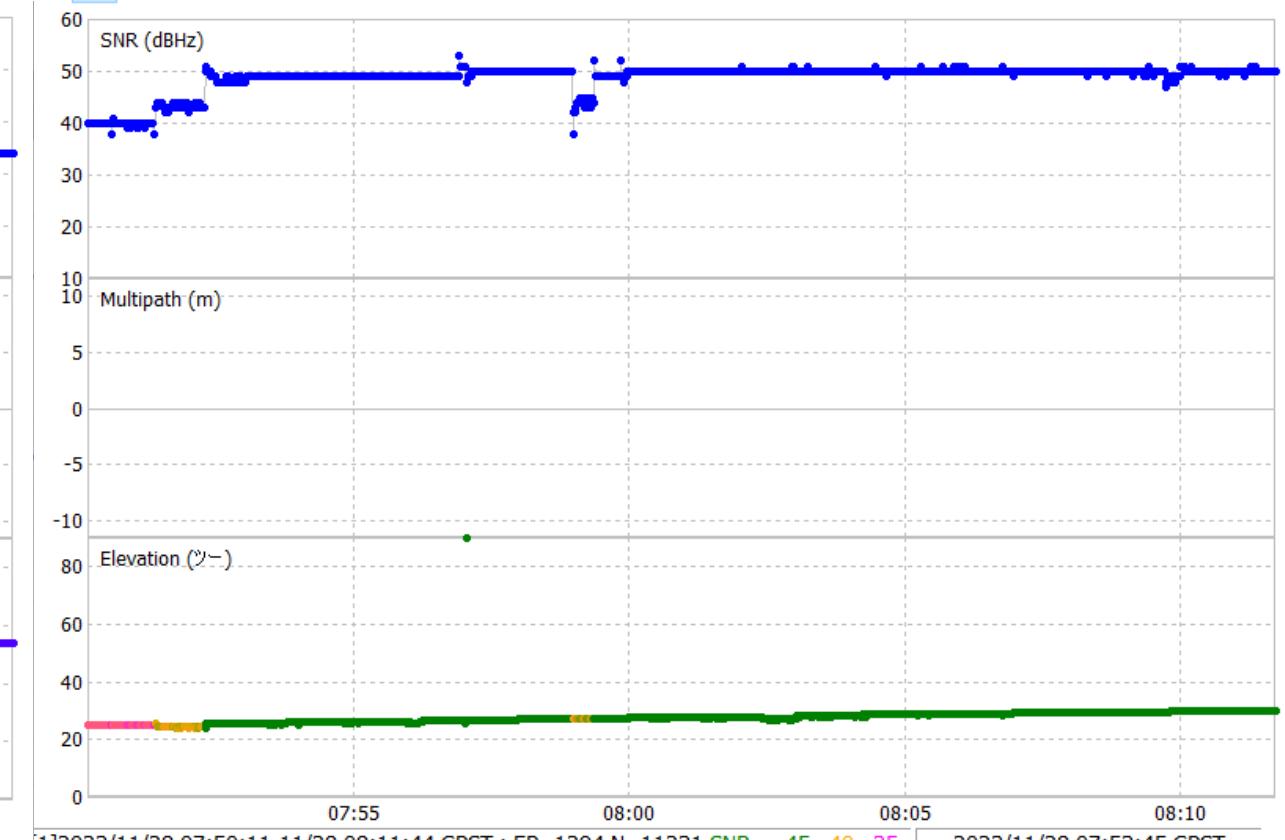


uBlox M8T Test

G16

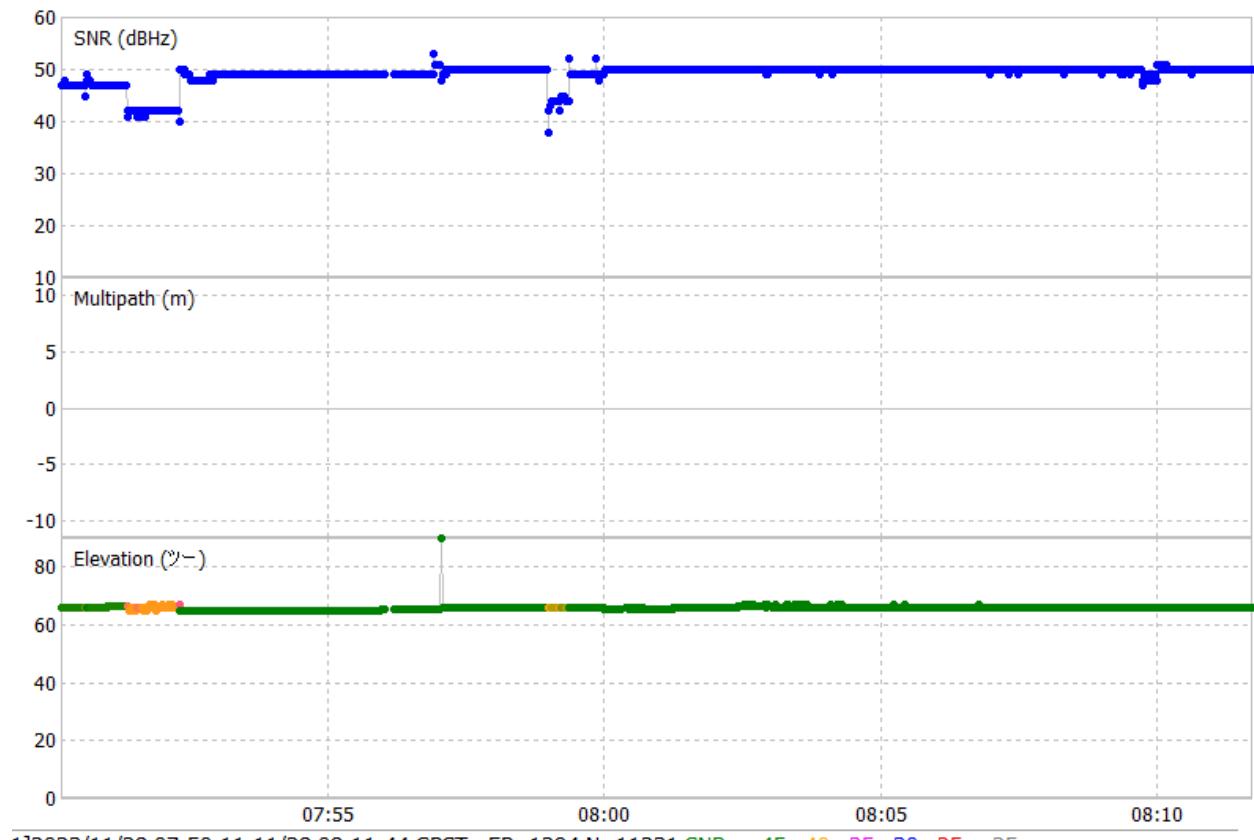


G18

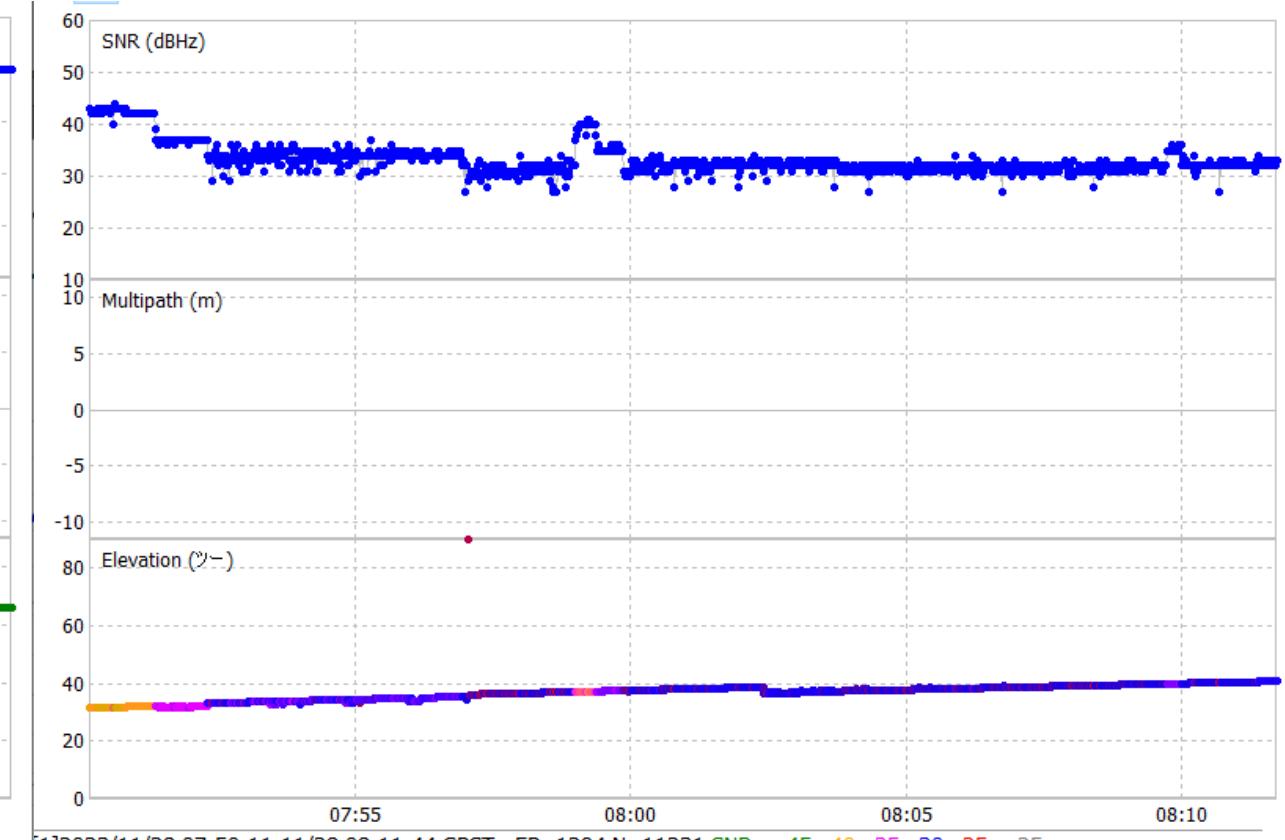


uBlox M8T Test

G26

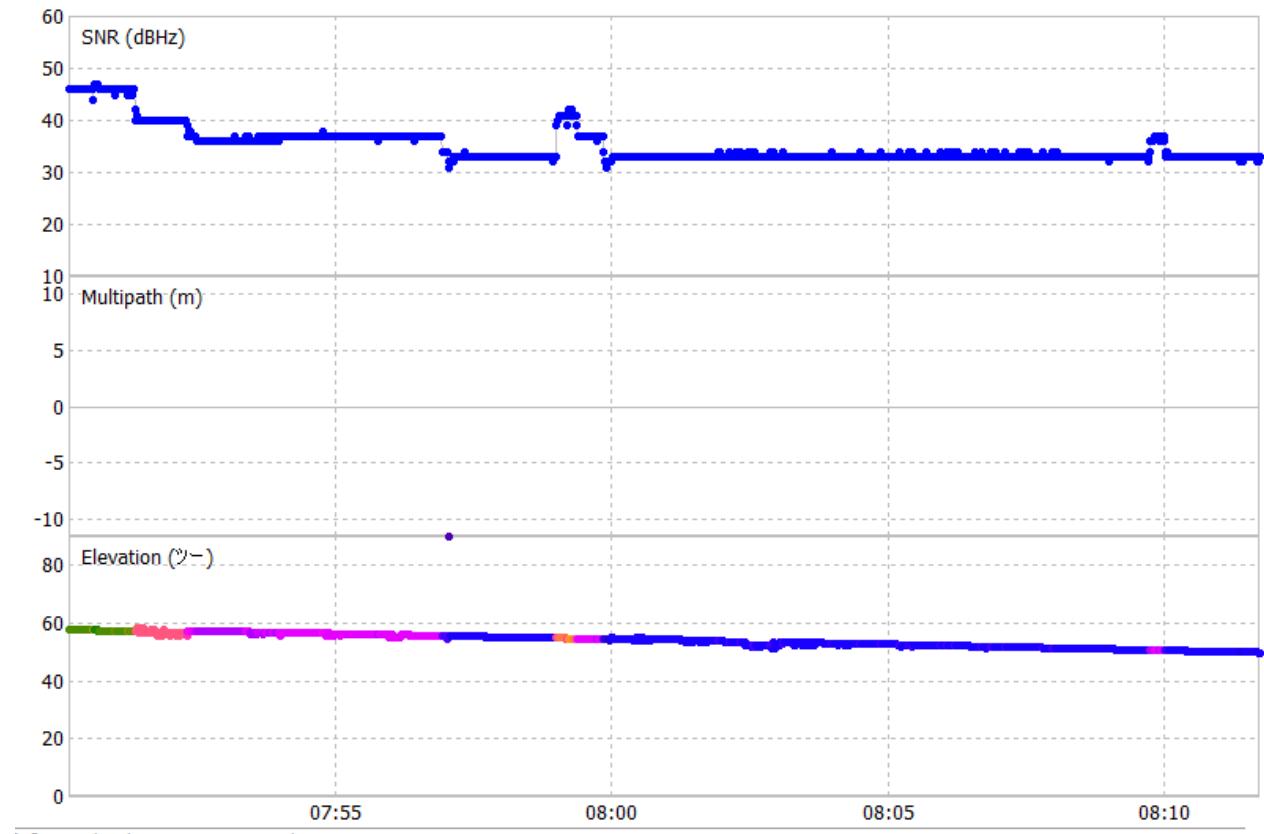


G27

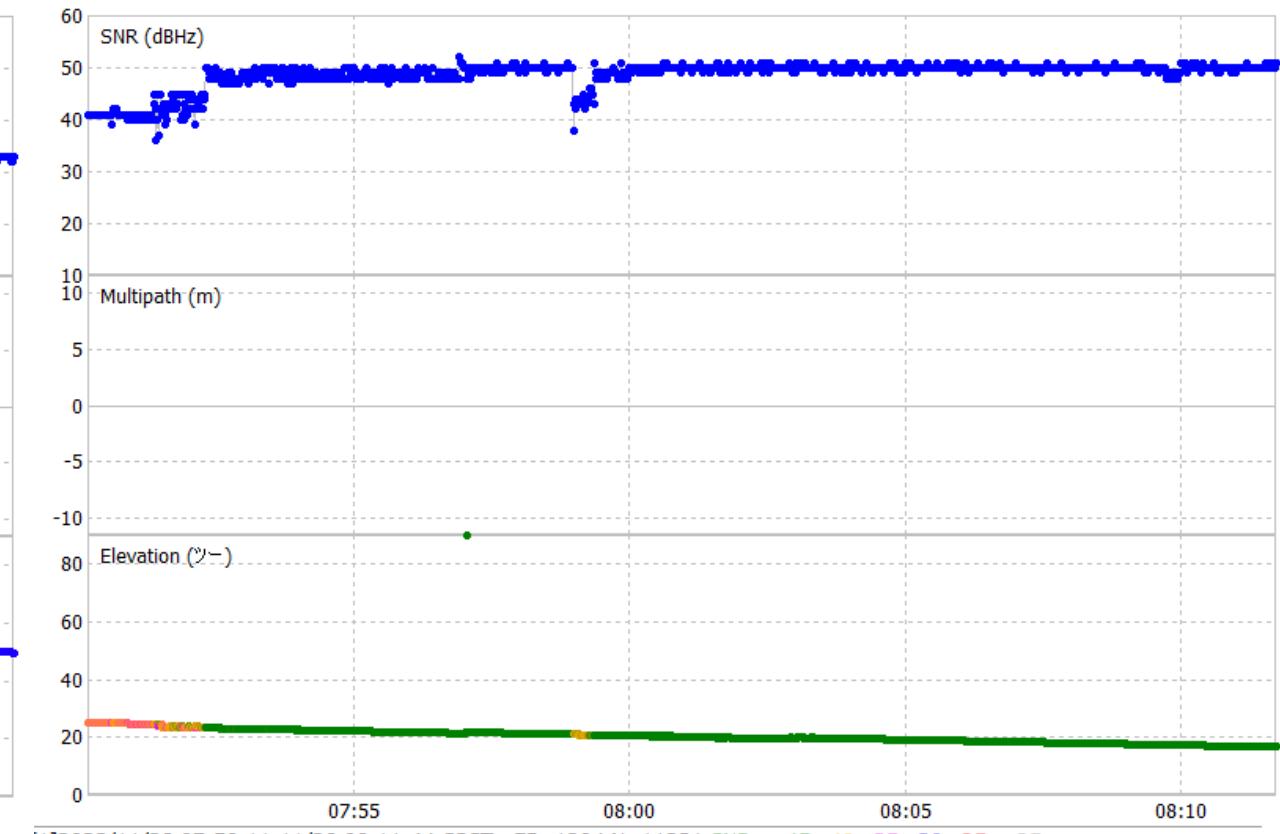


uBlox M8T Test

G28



G29

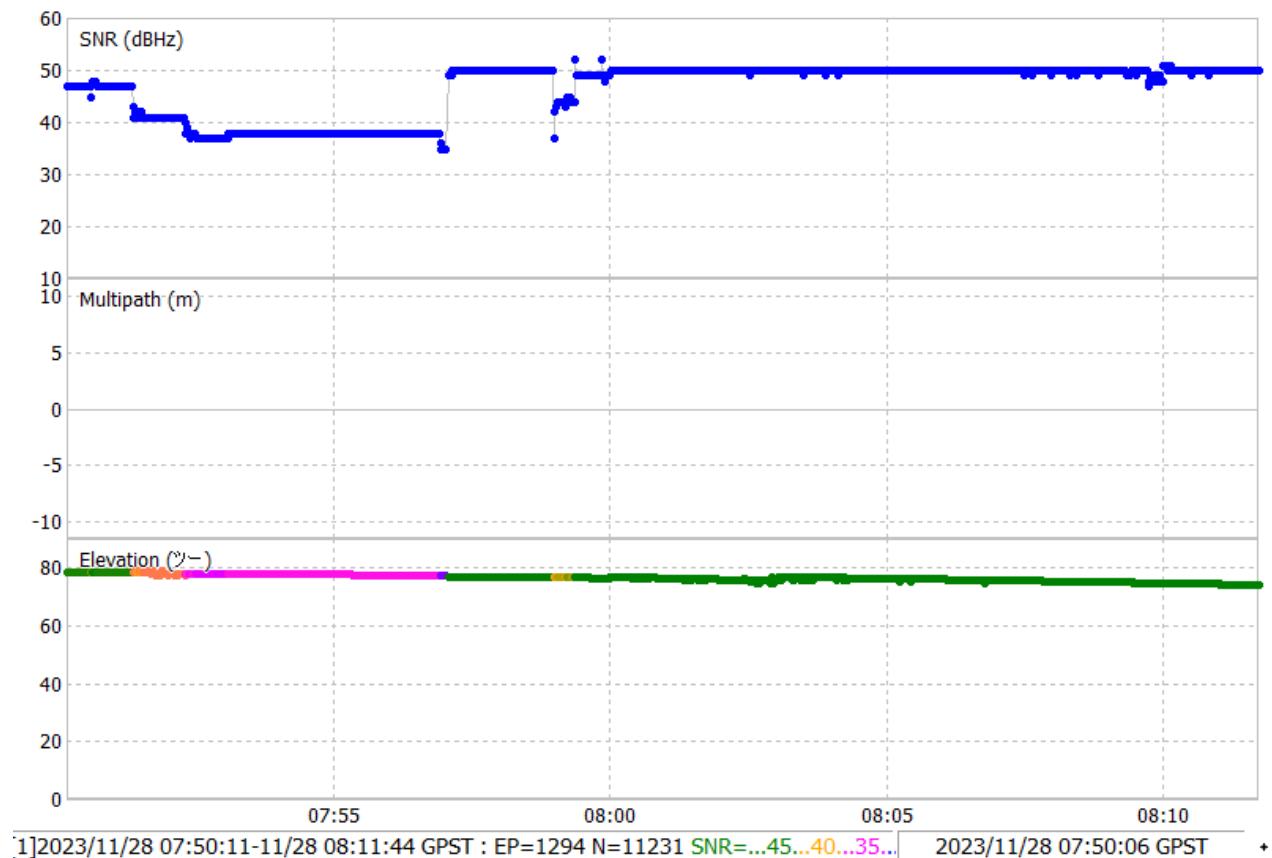


[1]2023/11/28 07:50:11-11/28 08:11:44 GPST : EP=1294 N=11231 SNR=...45...40...35...30...25 <25

+ [1]2023/11/28 07:50:11-11/28 08:11:44 GPST : EP=1294 N=11231 SNR=...45...40...35...30...25 <25

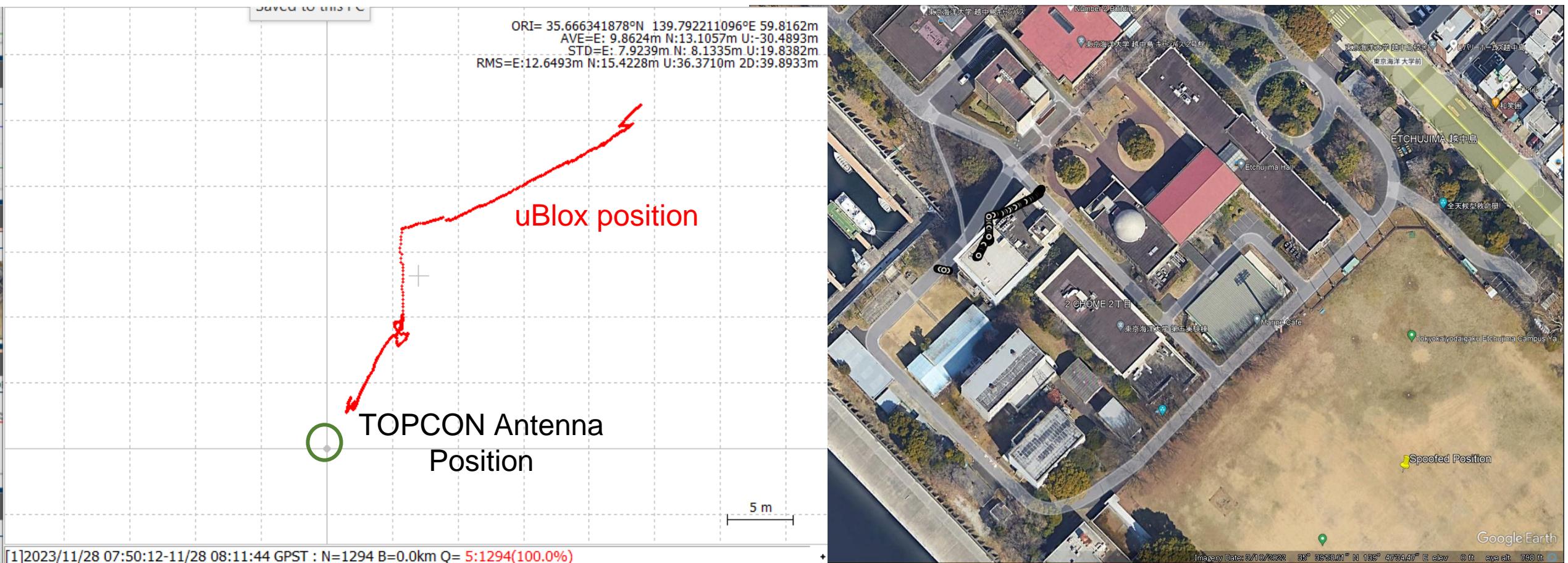
uBlox M8T Test

G31



uBlox M8T Test

Position Results



Experiment Setup – PocketSDR

Live Signals from Another Antenna



Novatel ProPak6

LIVE NAV DATA,
NMEA INPUT

1PPS INPUT



CLAW GPS
Simulator

DC Block

Spoof
Signals



Antenna

Live Signals



PC



Novatel Connect



SimCon

PocketSDR



PC

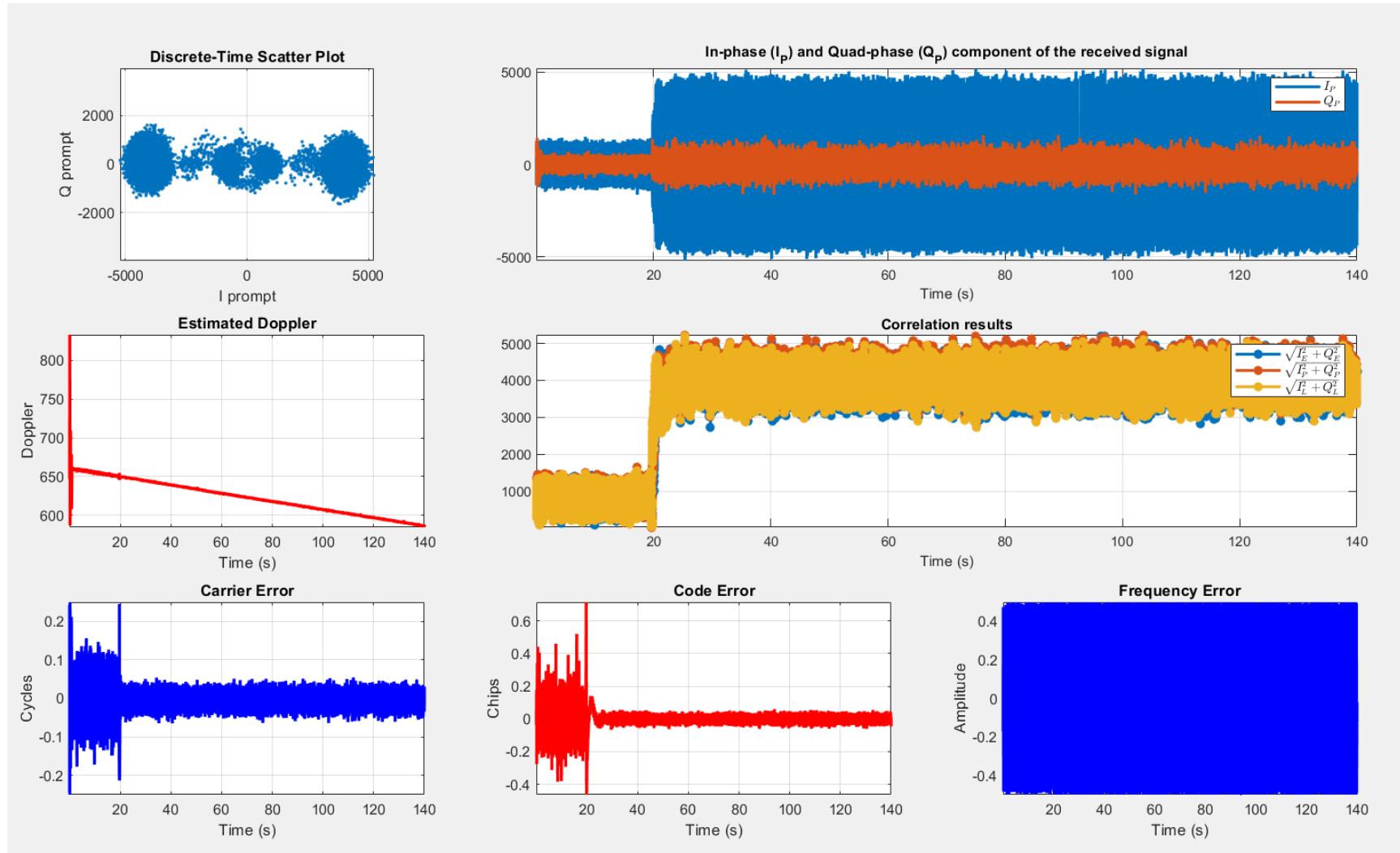
PocketSDR Test

Tracking Results

- 180 s data.
- I skipped first 40 s because of gap in data. Continuous tracking can't be done with this gaps.
- 9 satellites were tracked: G04, **G09**, G16, **G18**, G26, G27, G28, **G29**, and G31

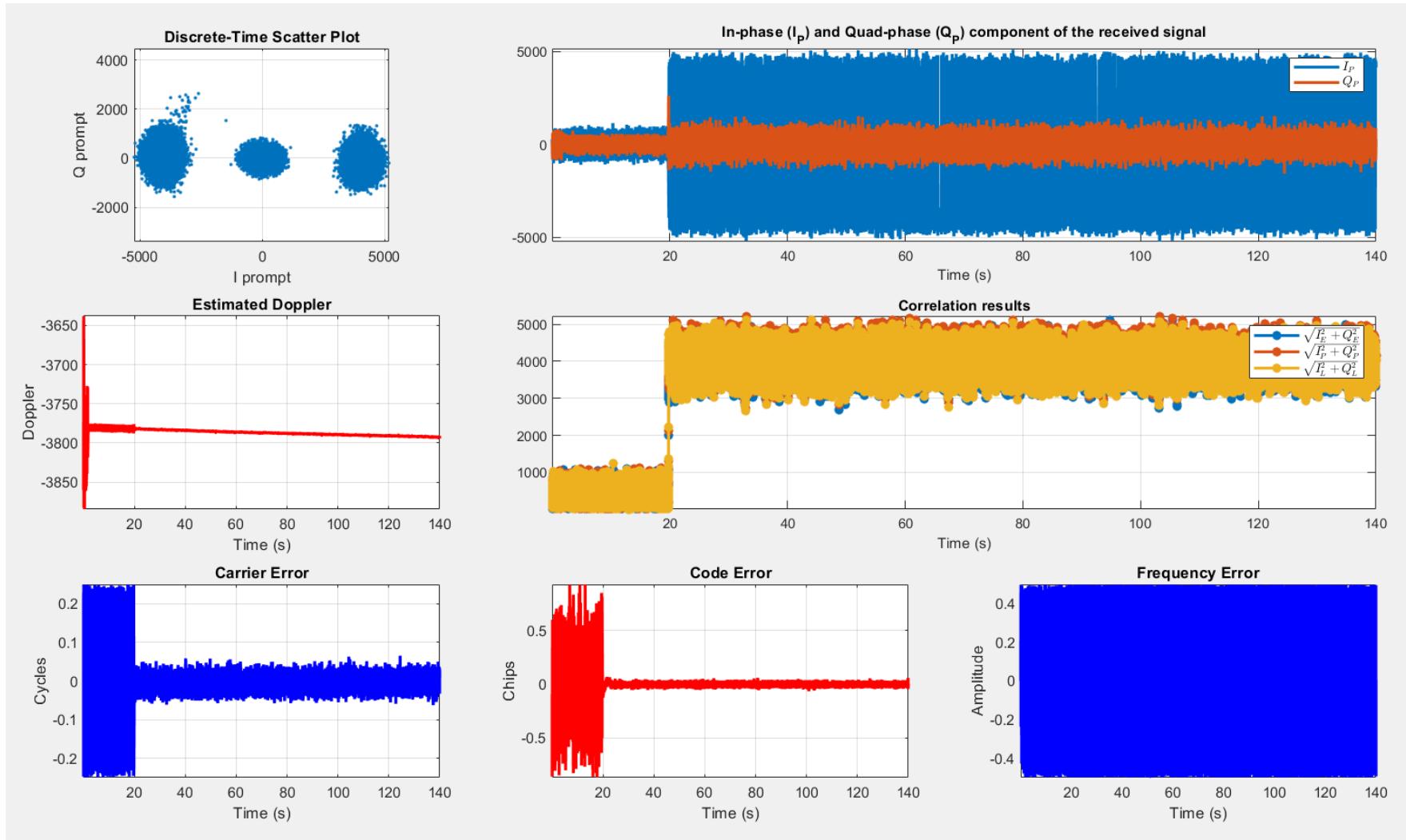
PocketSDR Test

PRN 18



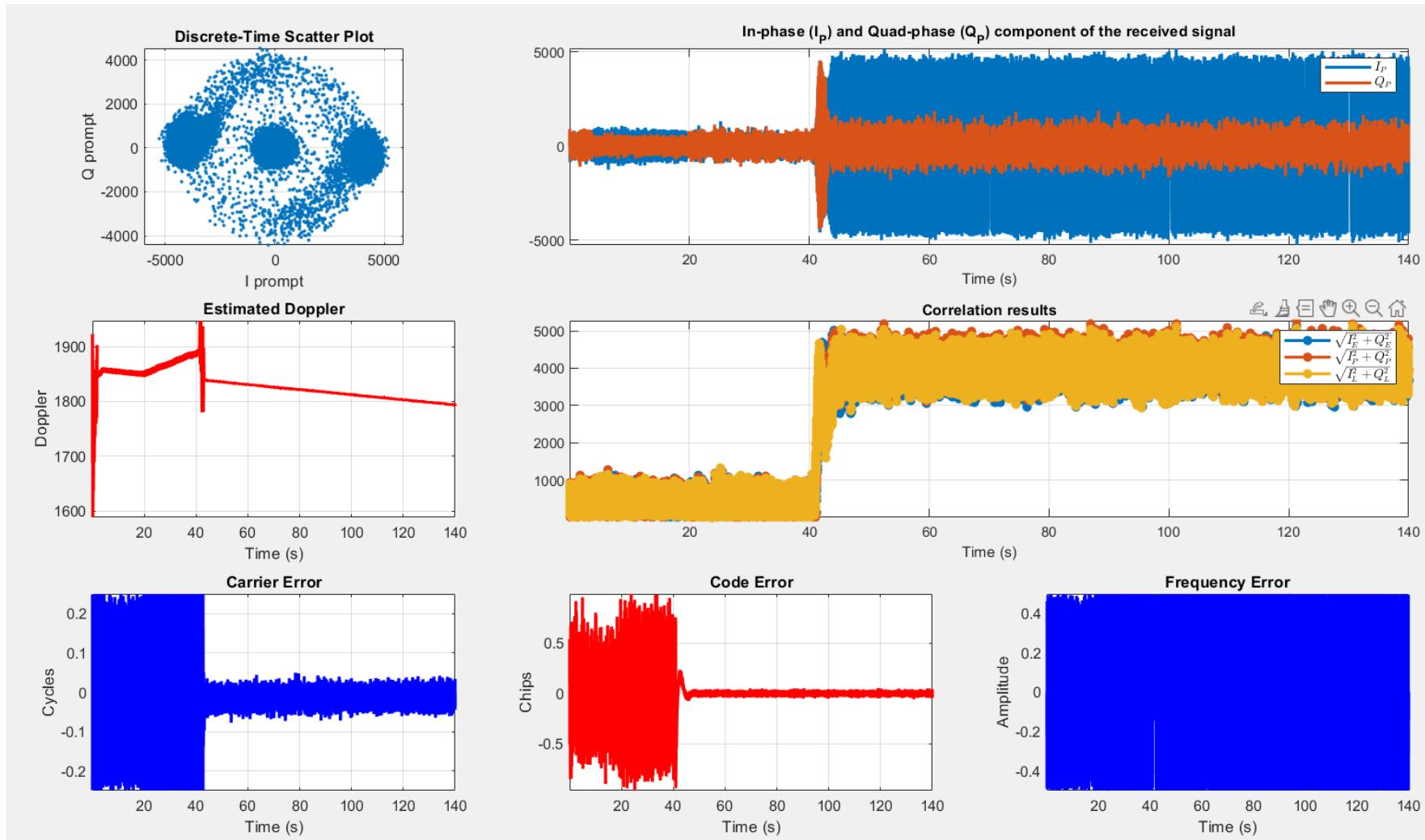
PocketSDR Test

PRN 29



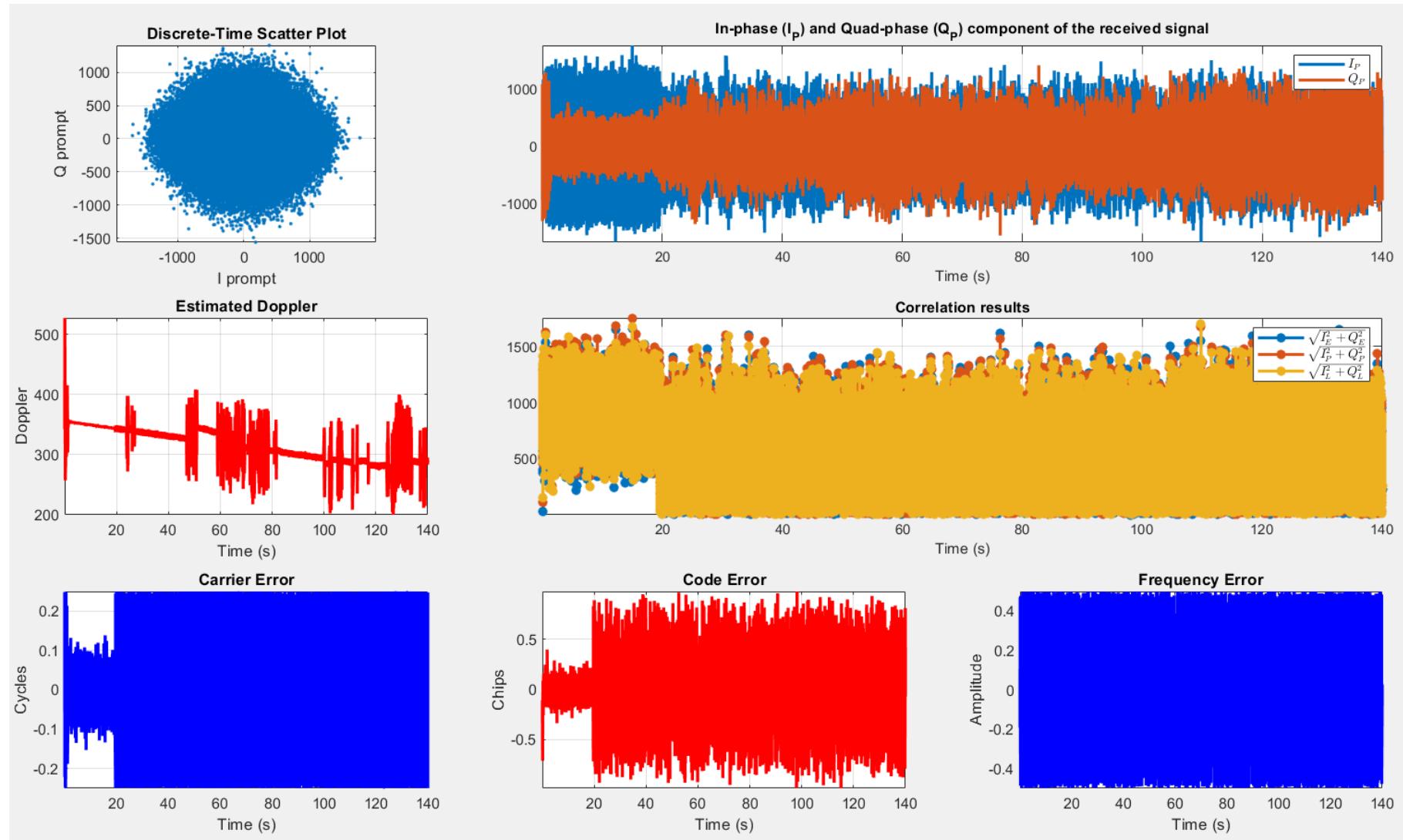
PocketSDR Test

PRN 09



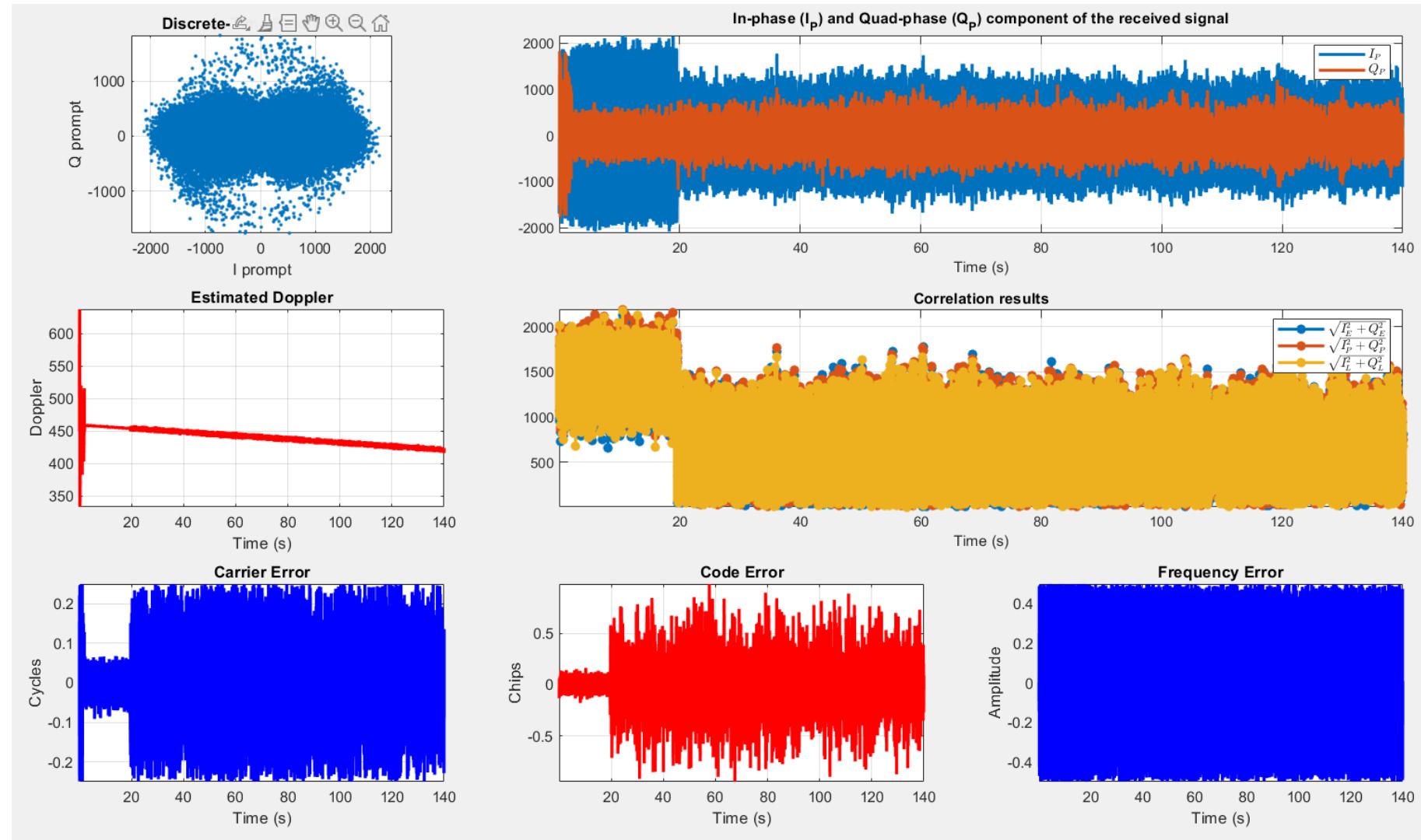
PocketSDR Test

PRN 04



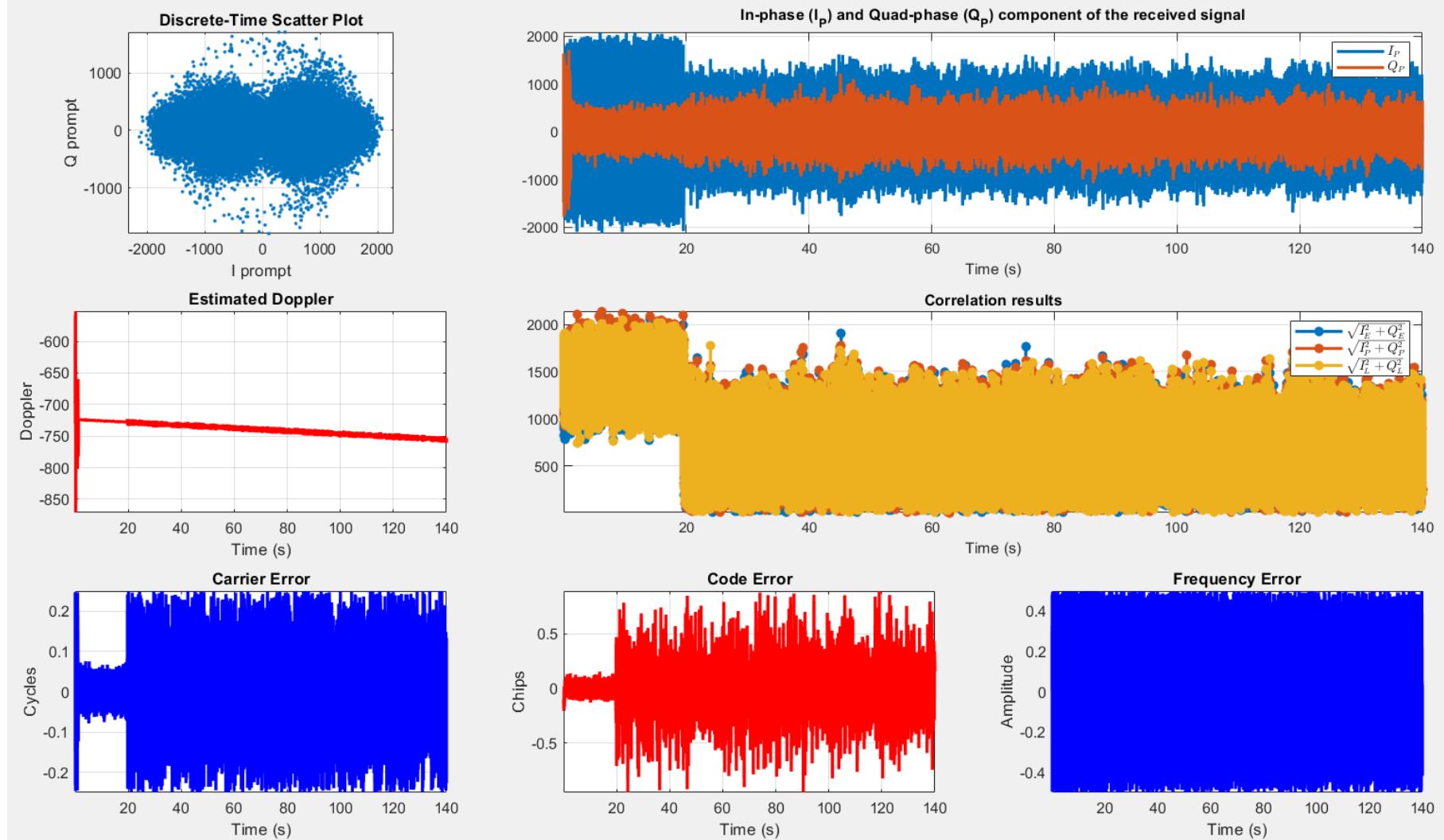
PocketSDR Test

PRN 16



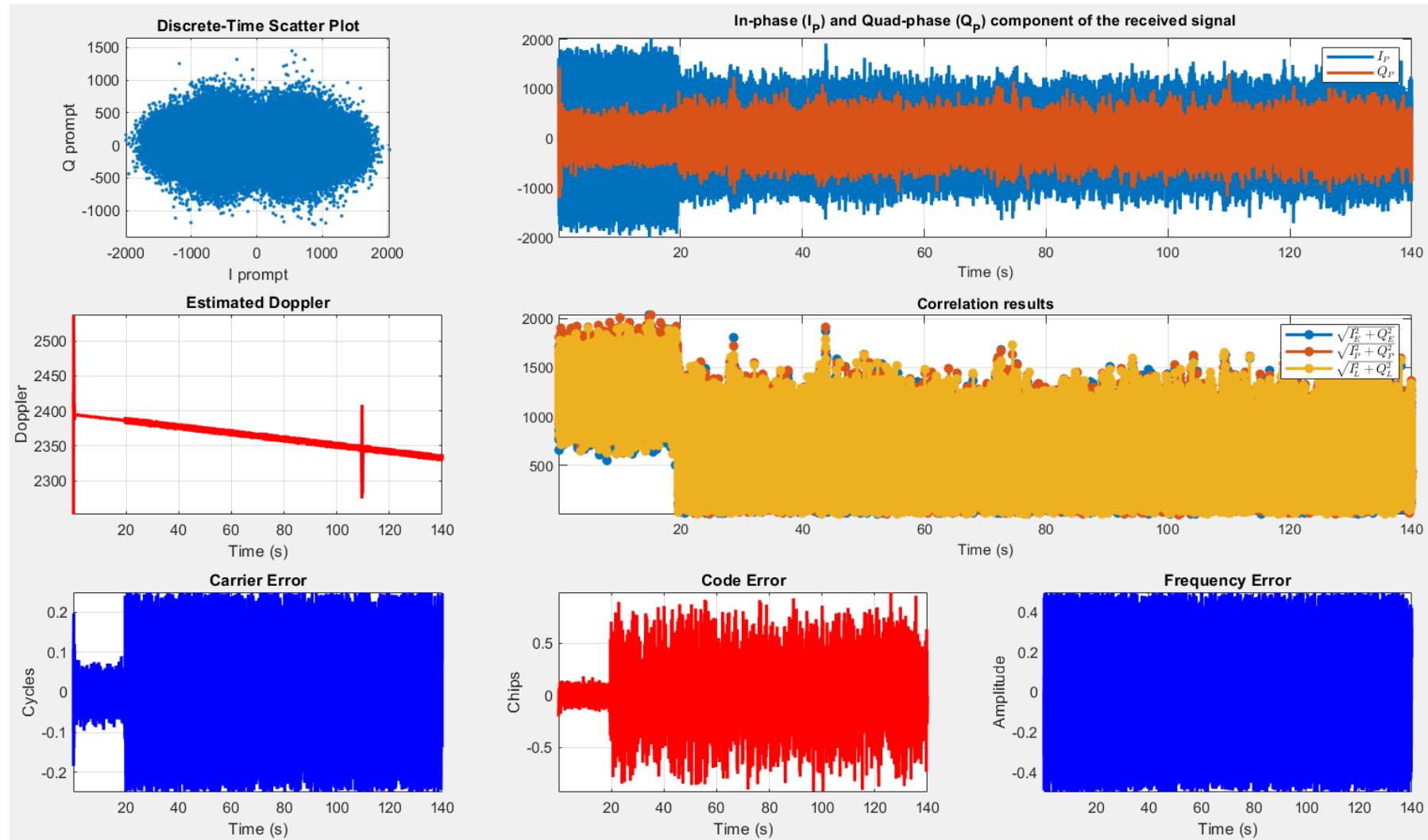
PocketSDR Test

PRN 26



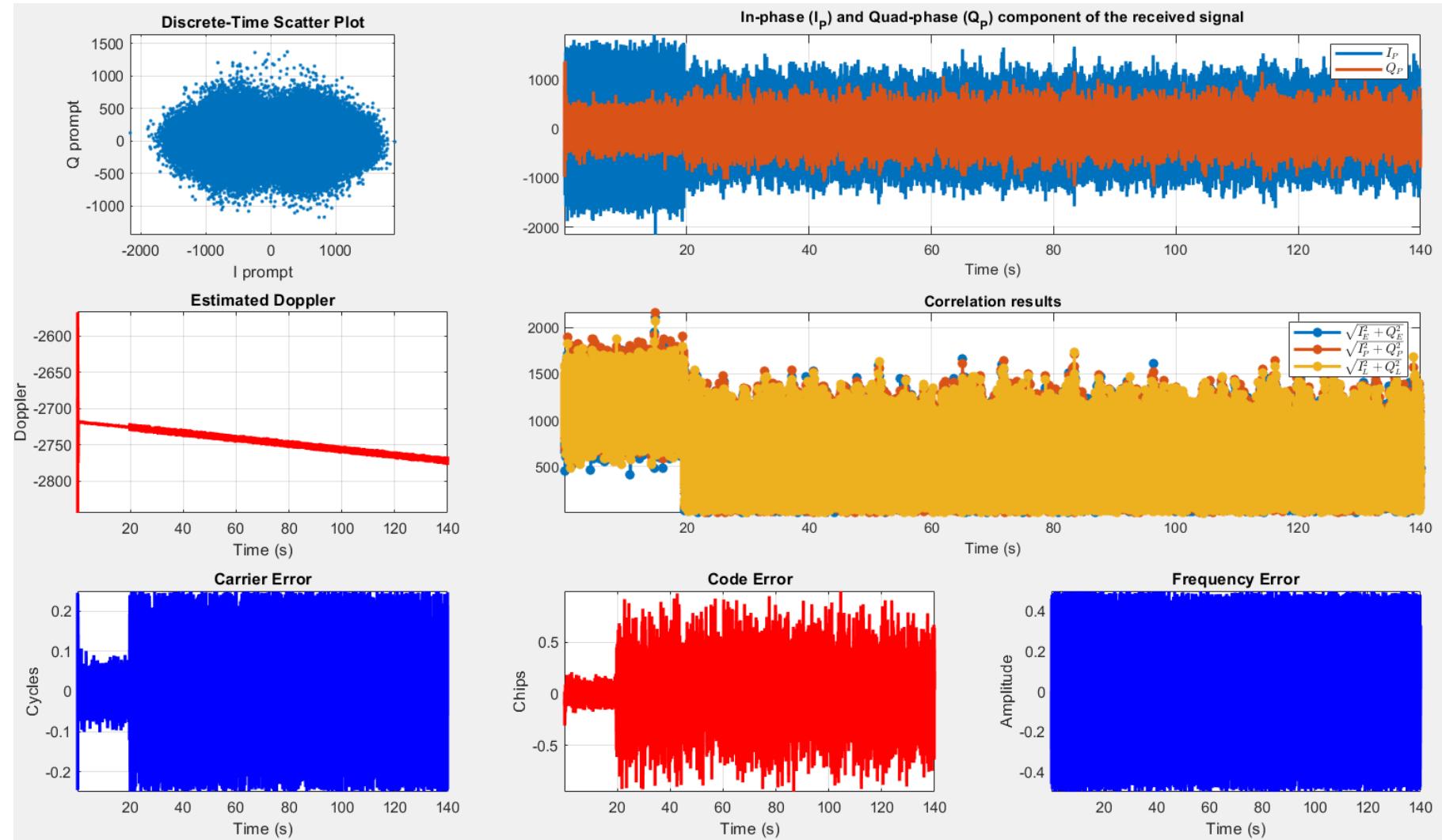
PocketSDR Test

PRN 27

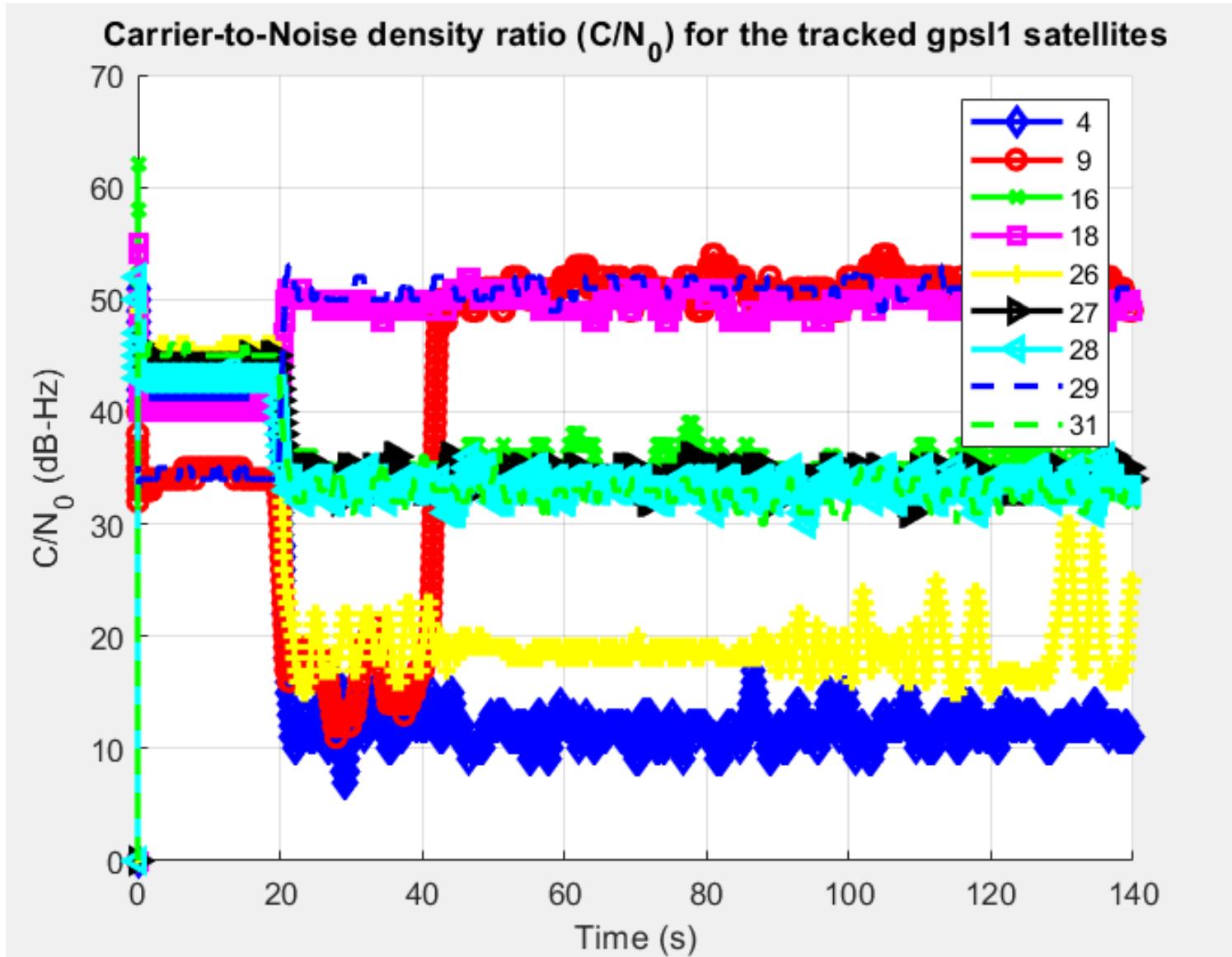


PocketSDR Test

PRN 28

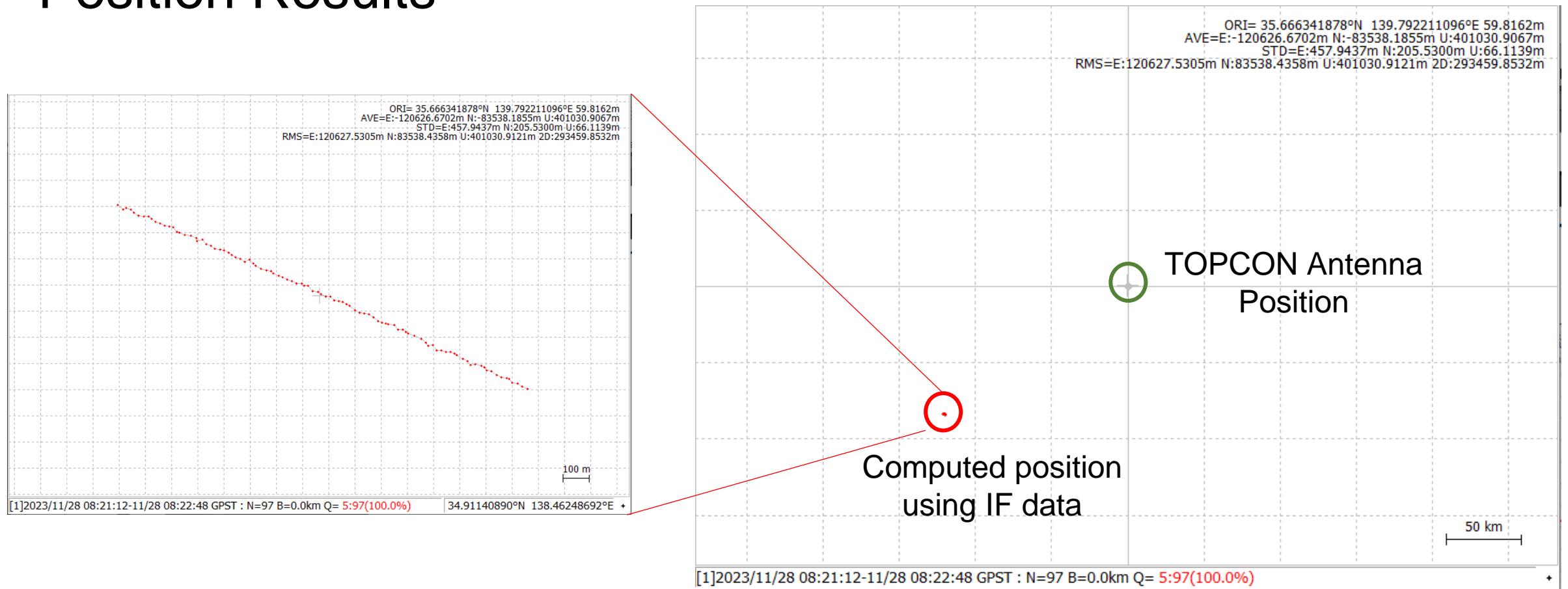


PocketSDR Test



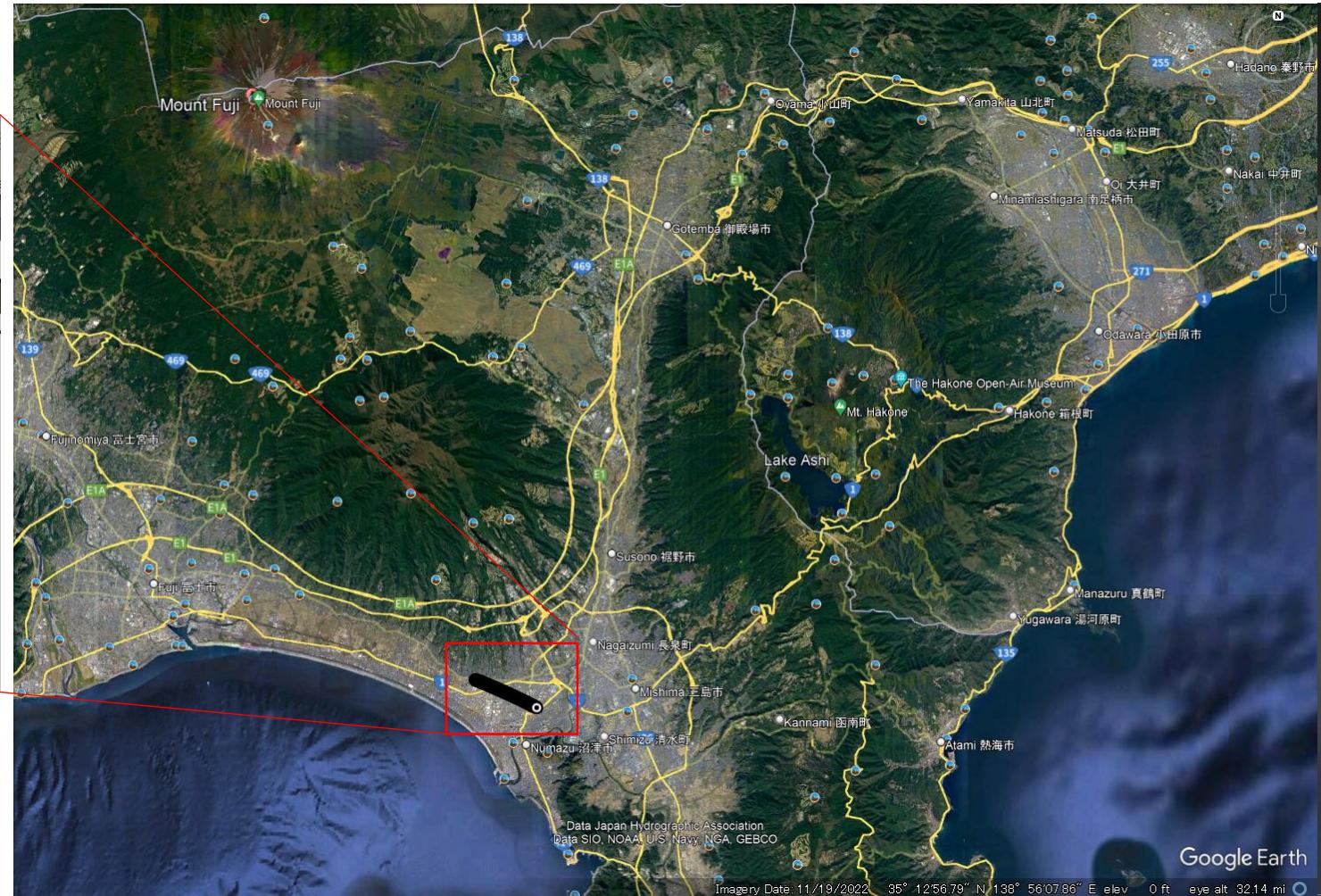
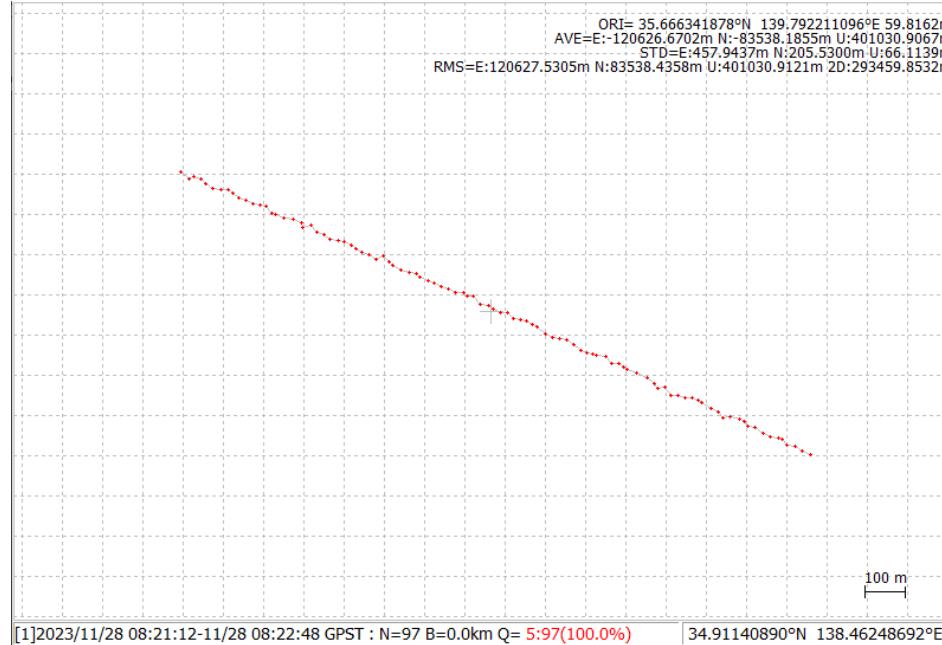
PocketSDR Test

Position Results



PocketSDR Test

Position Results



Summary

- Pixel 7a remained unspoofed.
- Xiaomi 11T Pro, uBlox M8T, PocketSDR computed positions deviate largely when the spoofer was turned on. For the case of Xiaomi 11T Pro, satellites from other constellations are still tracked. For uBlox M8T, it took time before the receiver tracks most spoofed signals.