Allystar Lowest Power and Size Single-chip Dual-frequency RTK

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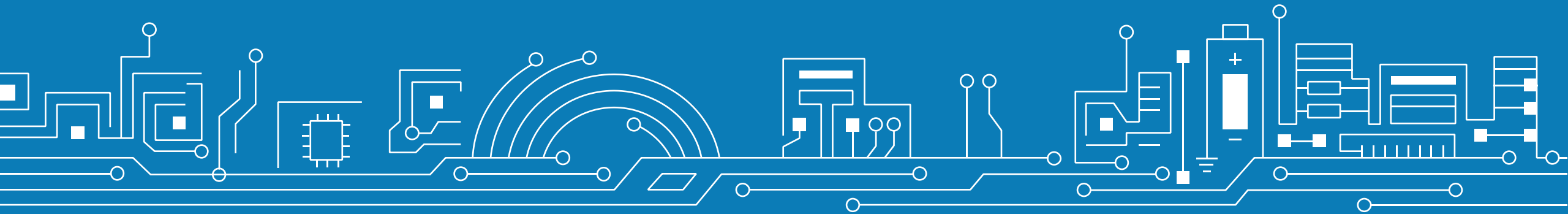
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Outline

- Allystar chips and RTK products

- Allystar RTK engine
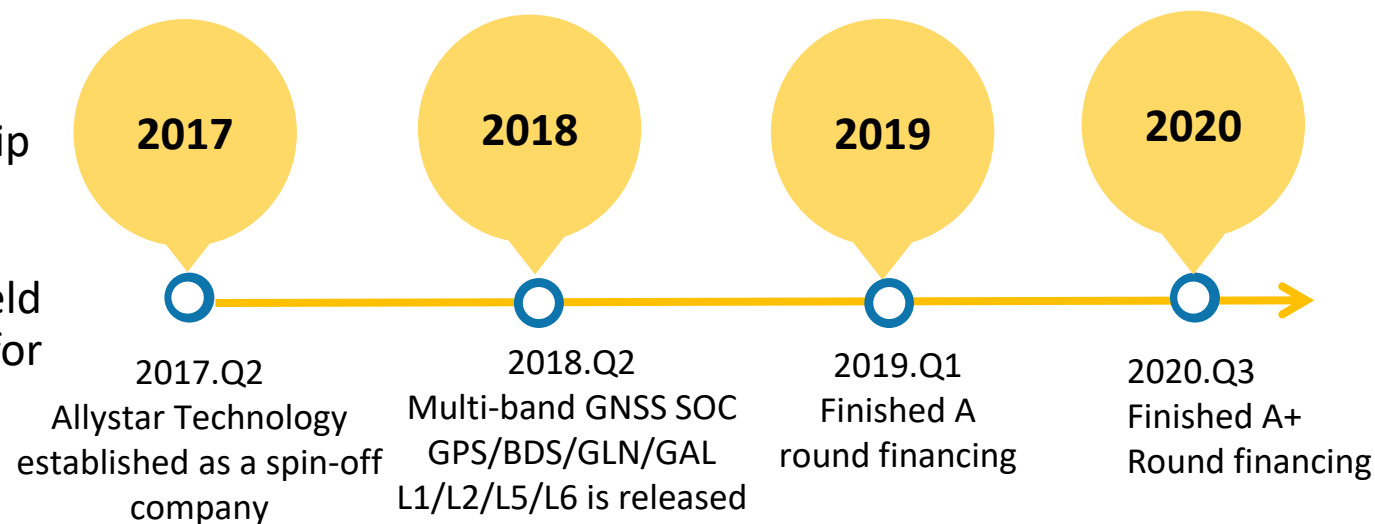
- Test data and results

About ALLYSTAR

ALLYSTAR

ALLY to associate or connect by some mutual relationship

STAR Pole Star, the true north

ALLYSTAR is a group of experienced people in GNSS field to create novel chips, modules, and algorithms for location technologies

Additional information: http://www.allystar.com/en/

2017

2018

2019

2020

2017.Q2
Allystar Technology established as a spin-off company

2018.Q2
Multi-band GNSS SOC GPS/BDS/GLN/GAL L1/L2/L5/L6 is released

2019.Q1
Finished A round financing

2020.Q3
Finished A+ Round financing

Complete GNSS team with GNSS RF, baseband, and algorithm experts to provide chip and module solutions

Multi-cultural GNSS team with experts from China, Hong Kong, Taiwan, Canada, and India

Pioneer GNSS team with leading multi-band GNSS product supporting L1, L2, L5, and L6 signals

About ALLYSTAR

ALLYSTAR multi-band GNSS module and evaluation kit
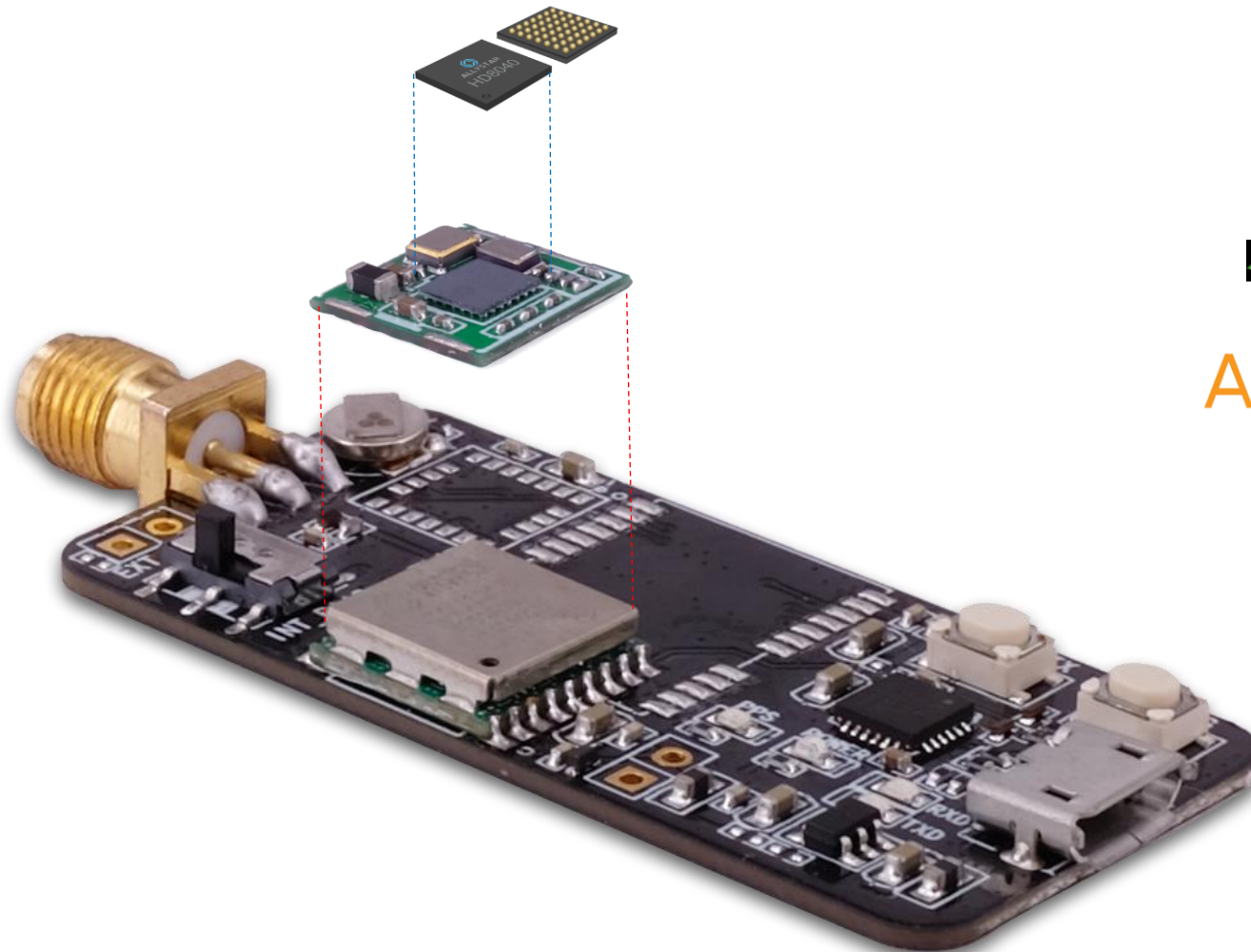
Kit available at retailers:

https://www.amazon.ca/dp/B086BG6QLX

Data GNSS
https://www.datagnss.com/products/

AliExpress
https://ali.onl/1Fjd

Module specifications	
Constellations	GPS+GLONASS+BeiDou+Galileo+ QZSS+IRNSS
Signals	L1, L2, L5, L6
Channels	40
Power consumption	100 mW (~30mA @ 3V3)
Size	7.6 x 7.6 mm
Positioning Modes	SPP, DGNSS, RTK

ALLYSTAR Multi-Band Multi-System Solution

Dual band GNSS receiver to cover all constellations in all bands for different applications
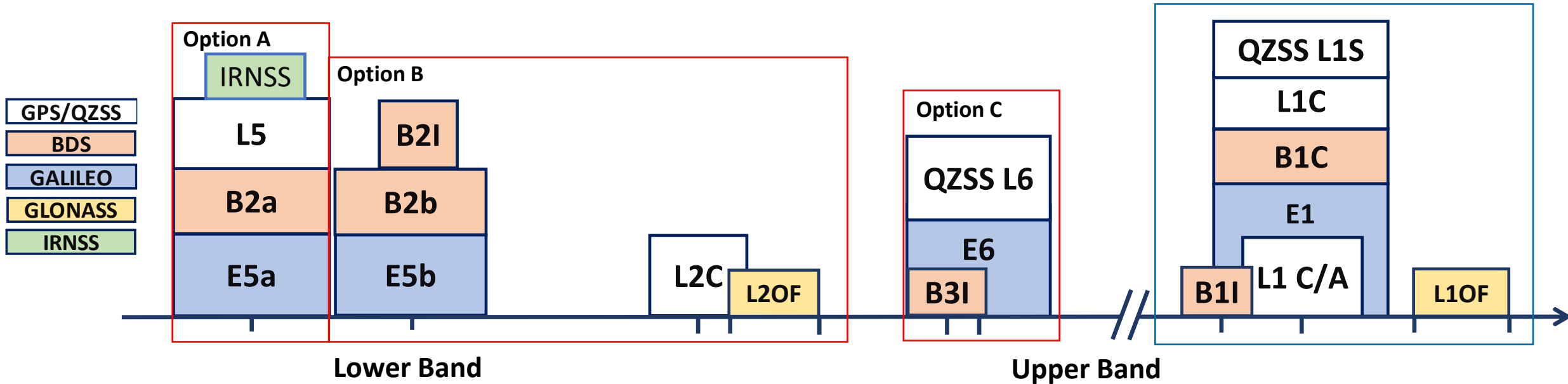
[Option A] L5 band: maximizes measurement accuracy and improve multipath mitigation
[Option B] L2 band: Common Worldwide CORS supports GPS L1 / L2 & GLONASS L1 / L2
[Option C] L6 band: Capability of receivers L6 signals for positioning and corrections

Allystar RTK product

- Built-in RTK engine running on a chip
    - Obtain cm-level solution with instant ambiguity fixing
    - Small size and power consumption

- Flexible signal options
    - GPS L1/L2C, BDS B1I/B2I, Galileo E1
    - GPS L1/L5, BeiDou B1I, Galileo E1/E5a
    - BeiDou B2a supported, not available in most stations yet
    - GPS L1, BeiDou B1, Galileo E1 (single-frequency)

- Support RTCM standard 10403.3

- High reliability and high availability firmware options

Specification compared to competitors

Manufacturer and model	Signal bands	Chip Size	Module Size	Max Power consumption / Max current
Allystar TAU1312	**L1/L2, L1/L5, L1/L6**	**3.0x3.0 mm^2**	**7.6 x 7.6 mm^2**	**47 mA**
U-Company	L1/L2	?	22.0 x 17 mm^2	130 mA (85 mA tracking)
M-Company	L1/L2	?	22 X 17 mm^2	150 mA
T-Company	L1/L2	?	71 X 46 mm^2	400 mA

RTK power consumption, Allystar TAU1312 RTK module

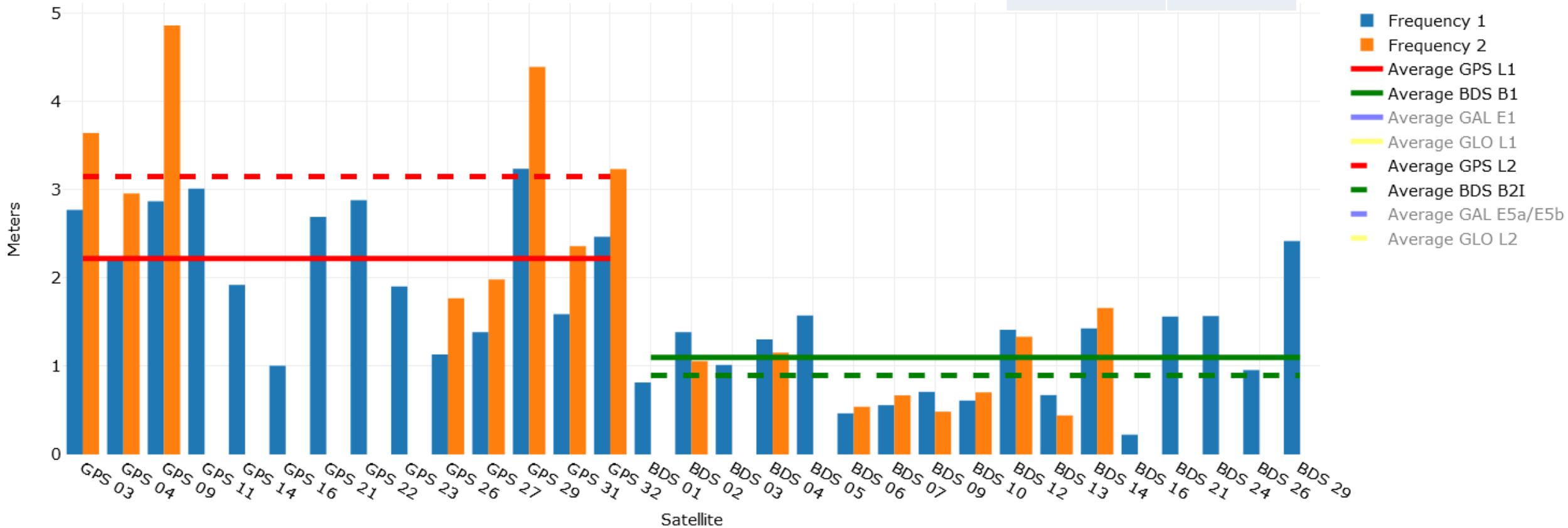| Power consumption (mA) @GPS/BDS			
Model	**Acquisition**	**Tracking (SPP mode)**	**Tracking (RTK mode)**
TAU1312	39	39	39
U-Company	95	102	104
M-Company	126	117	118
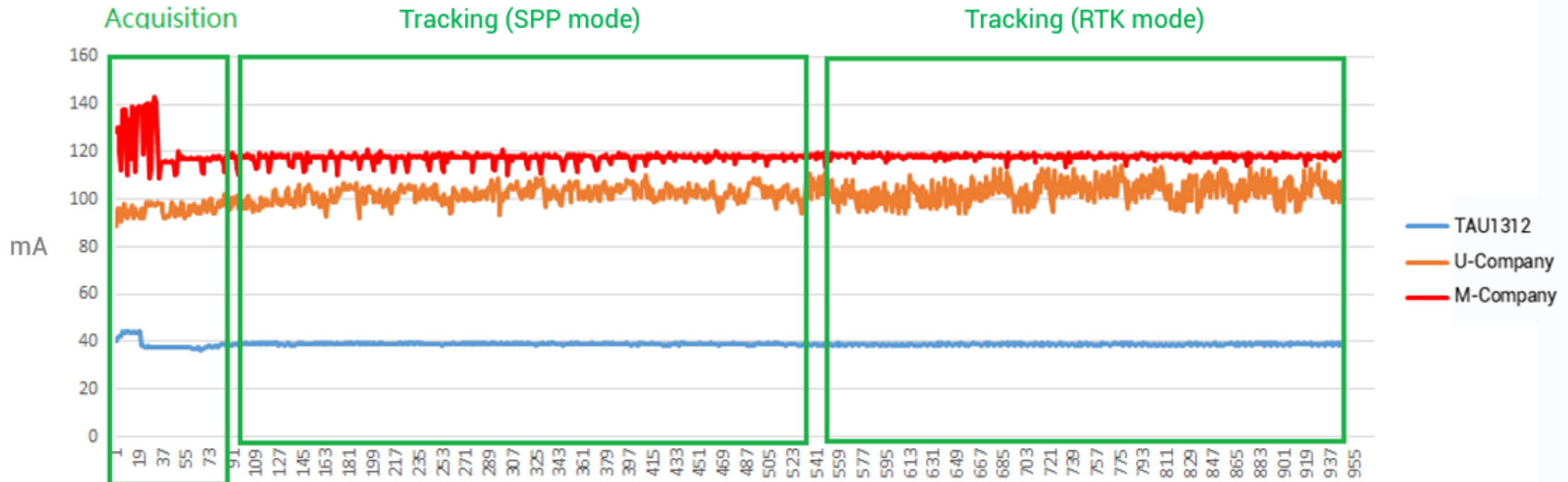
Allystar tracking quality in challenging kinematic environment L1/L2

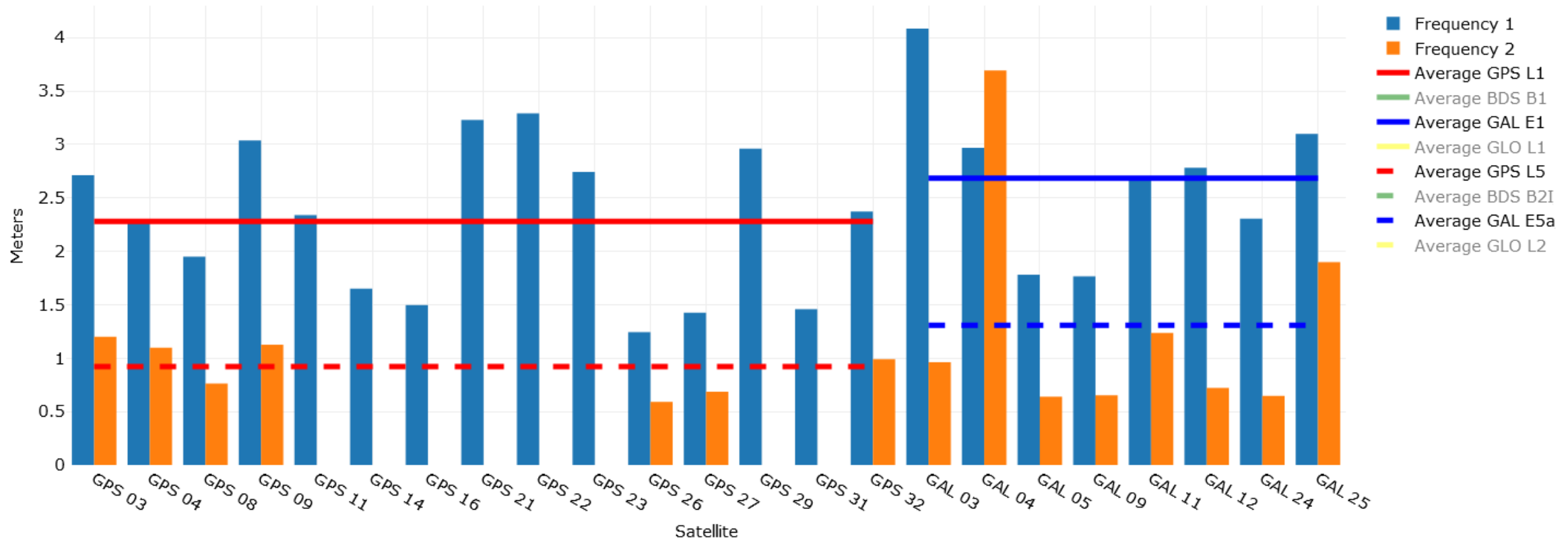Code-phase multipath based on code-minus carrier

Signal	RMS(m)
GPS L1	2.2
GPS L2C	3.2
BeiDou B1	1.1
BeiDou B2	0.9

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Allystar tracking quality in challenging kinematic environment L1/L5

Code-phase multipath based on code-minus carrier

Signal	RMS(m)
GPS L1	2.3
GPS L5	0.9
Galileo E1	2.7
Galileo E5a	1.3

Principle of RTK

- Use observations from a base-station at know location
  - Do single difference between base and rover to mitigate/cancel common error sources such as ionosphere and satellite clock and orbit

- After that do between-satellite-difference for the observations to cancel receiver clock error and biases

- Use both carrier-phase and code-phase observations
  - Carrier-phase has mm-level precision, but unknown ambiguity term

Allystar RTK algorithm

- Use an extended Kalman filter to estimate following states
  - Position, Velocity, Double-differenced carrier-phase ambiguities

- Primary focus on VRS and short base-line RTK
  - No need to estimate slant ionospheric delay

- Use LAMBDA method for ambiguity resolution

- Weight observations based on CN0, elevation and multipath level

Allystar RTK firmware options

- ## High reliability mode
  - Aim to have small as possible wrong fixing rate
  - Aim to have always less than 30 cm horizontal error in fix ambiguity solution
  - Recommended for sensor fusion applications

- ## High availability mode
  - Aim to higher fixing rate
  - Aim to have always smaller than 1 m horizontal in fix ambiguity solution
    - E.g. permit some partially wrong fixes
  - Recommend for general users

Field test

- Compare Allystar RTK performance to U and M-company receivers

- Use NovAtel SPAN system as a refence

- Environment is primary challenging
  - Sections of high multipath
  - Partial and full signal blockages

Test setup/route pictures

Shenzhen test 1 route

Use GPS L1/L2 and BeiDou B1I/B2I
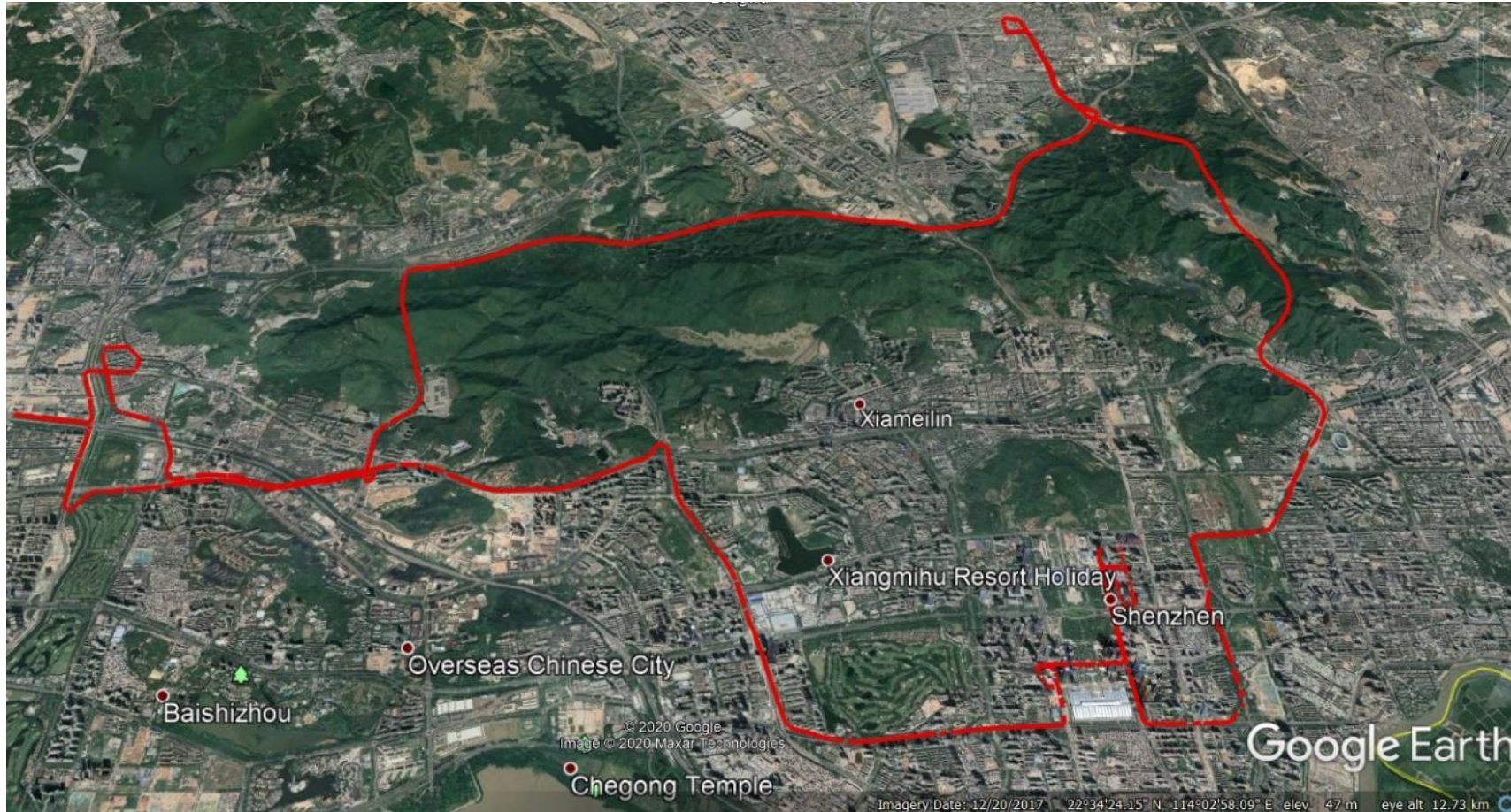
Shenzhen test 1 – high availability mode
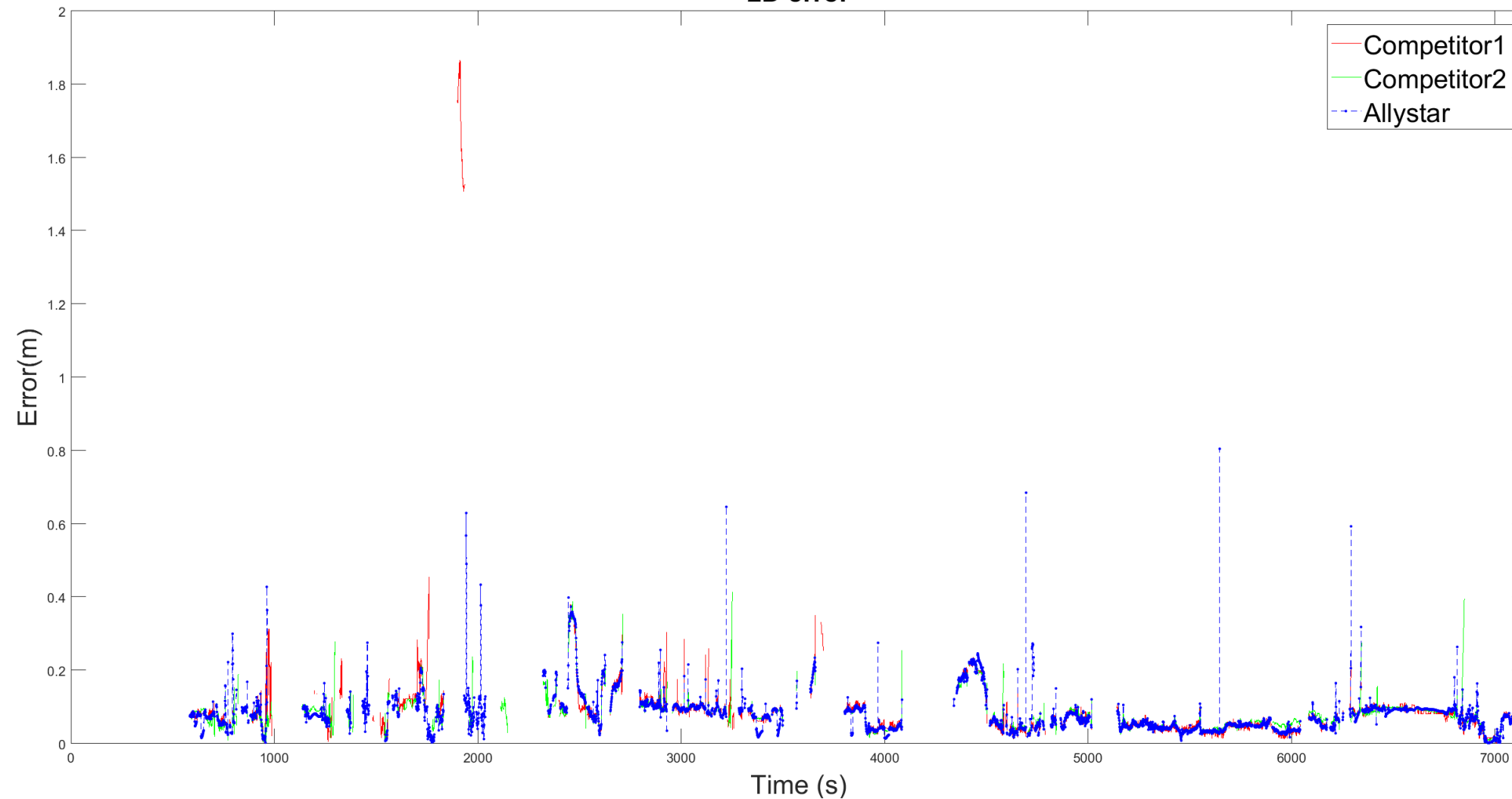
2D error

Rec	Fix rate
Allystar	64.67%
Comp1	61.21%
Comp2	62.66%

Shenzhen test 1 – high reliability mode

2D error
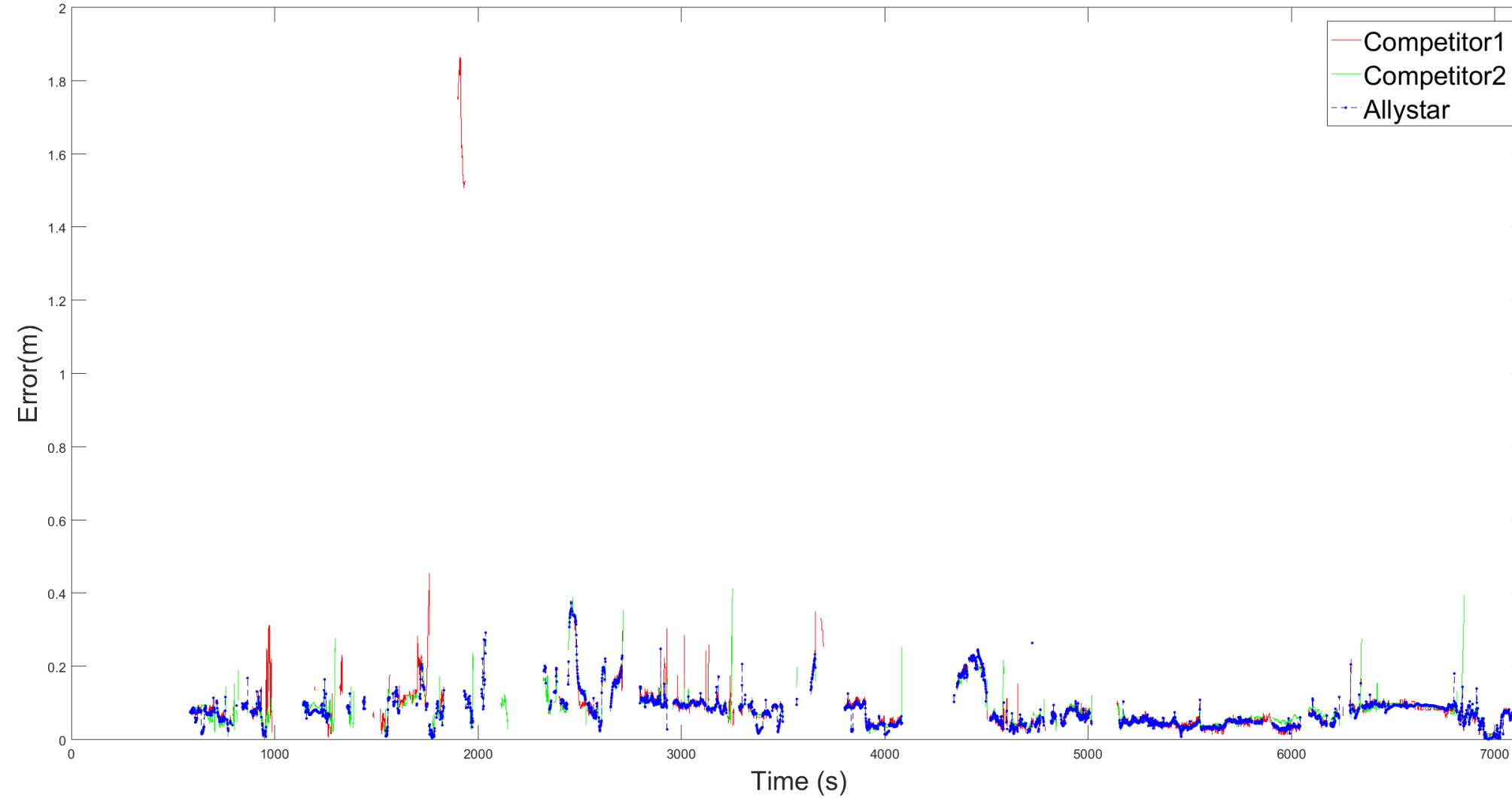
Rec	Fix rate
Allystar	59.70%
Comp1	61.21%
Comp2	62.66%

Shenzhen test 1- valid satellite count and correction age
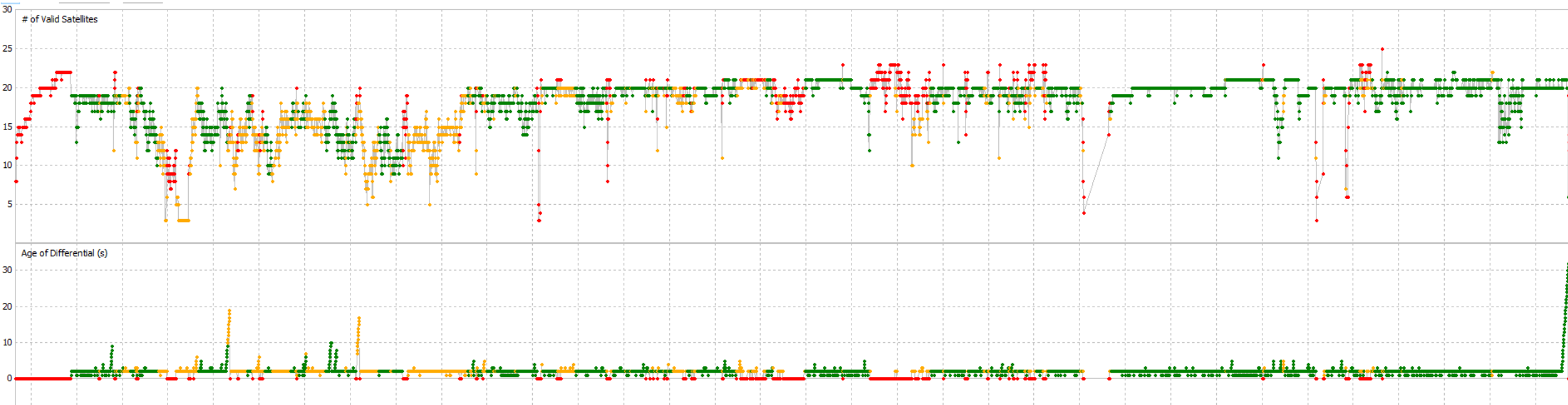
- Green = RTK fixed solution
- Yellow = RTK float solution
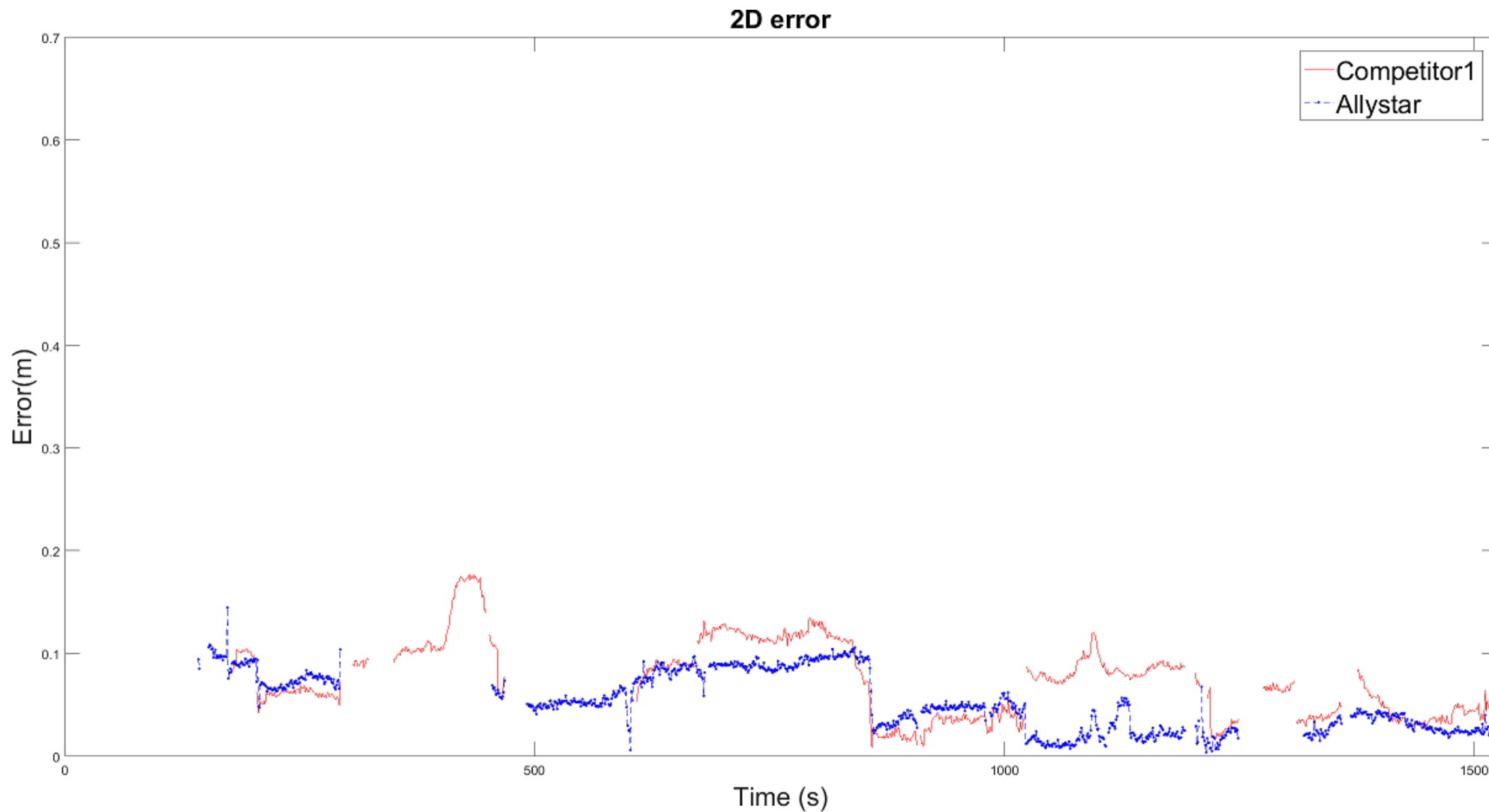- Red = Uncorrected solution (PVT)

Use GPS L1/L2 and BeiDou B1I/B2I
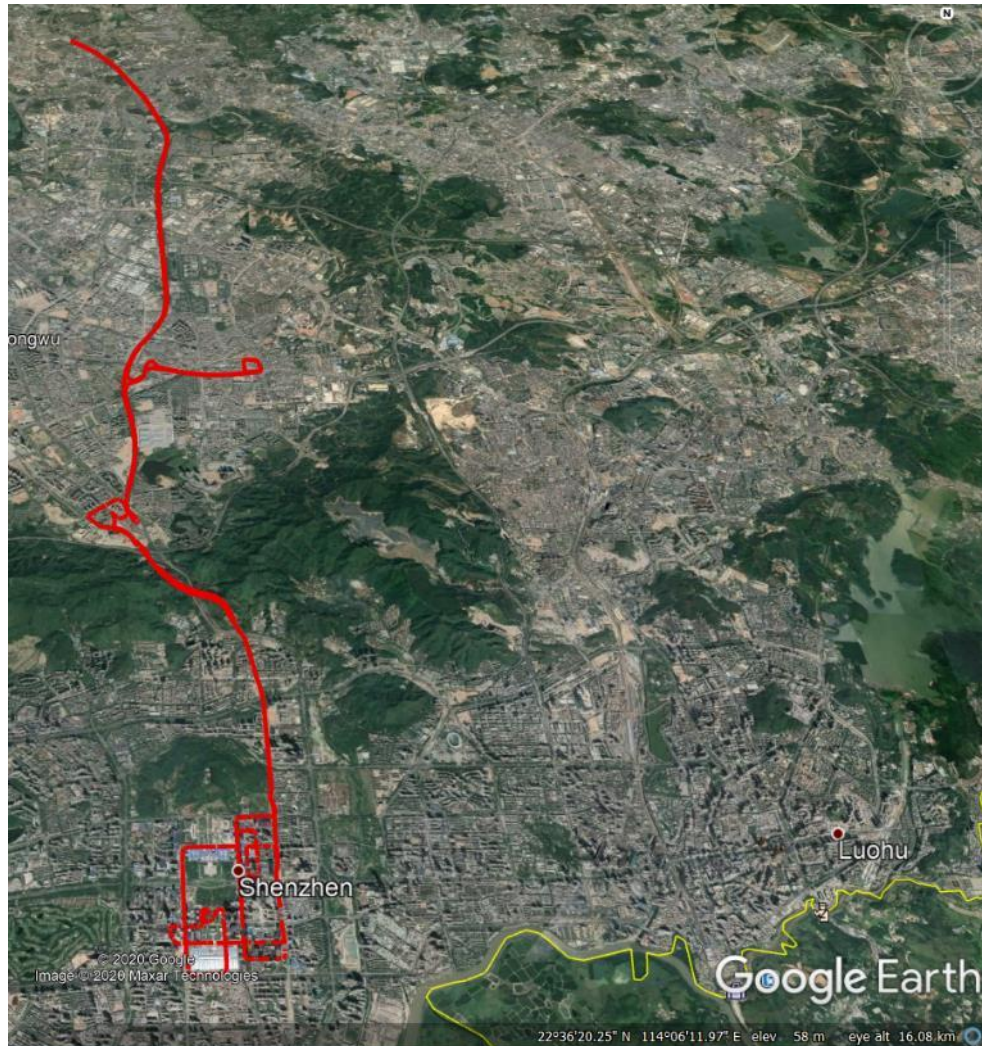
Shenzhen test 2 – high availability mode

2D error
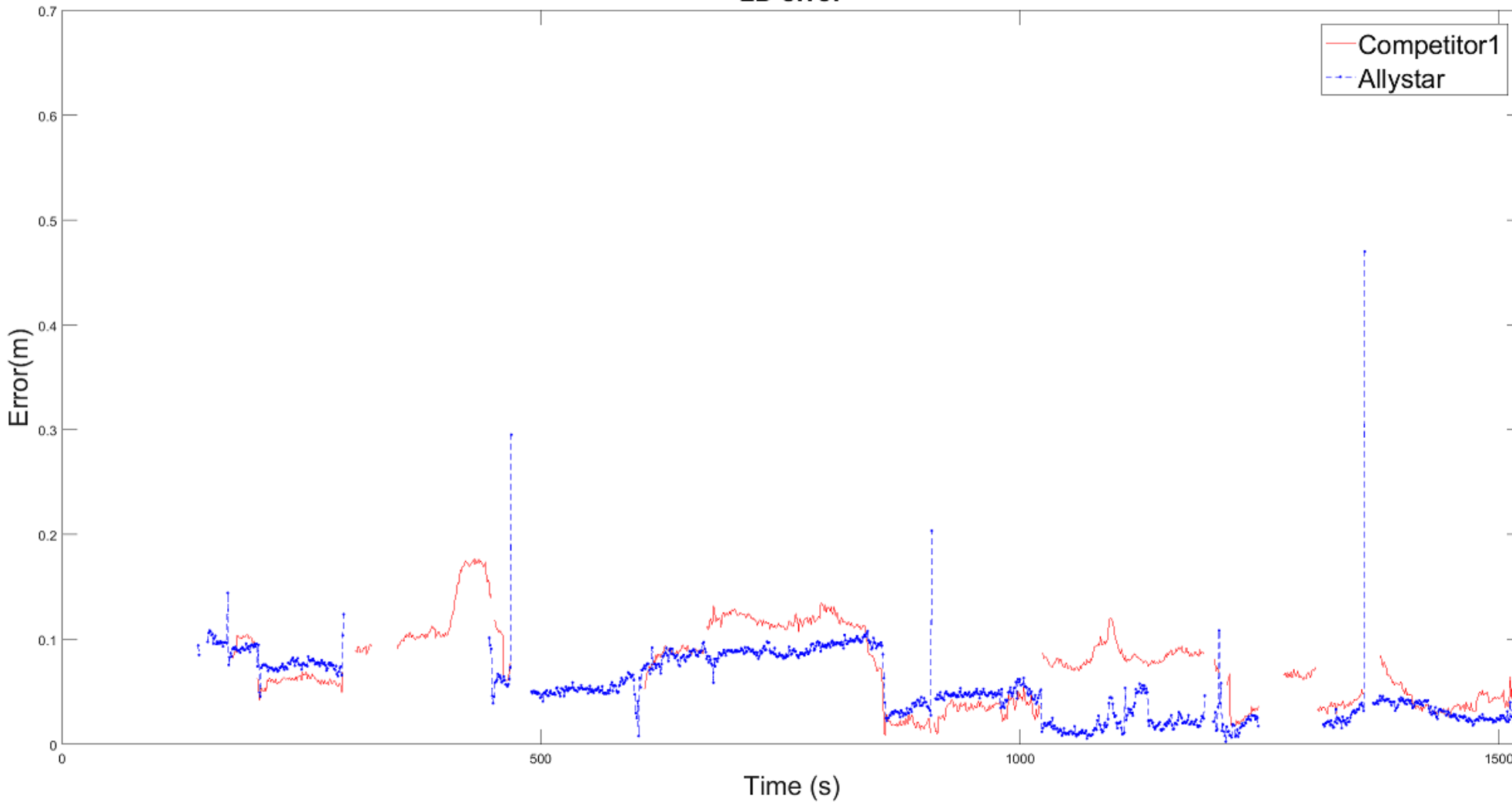
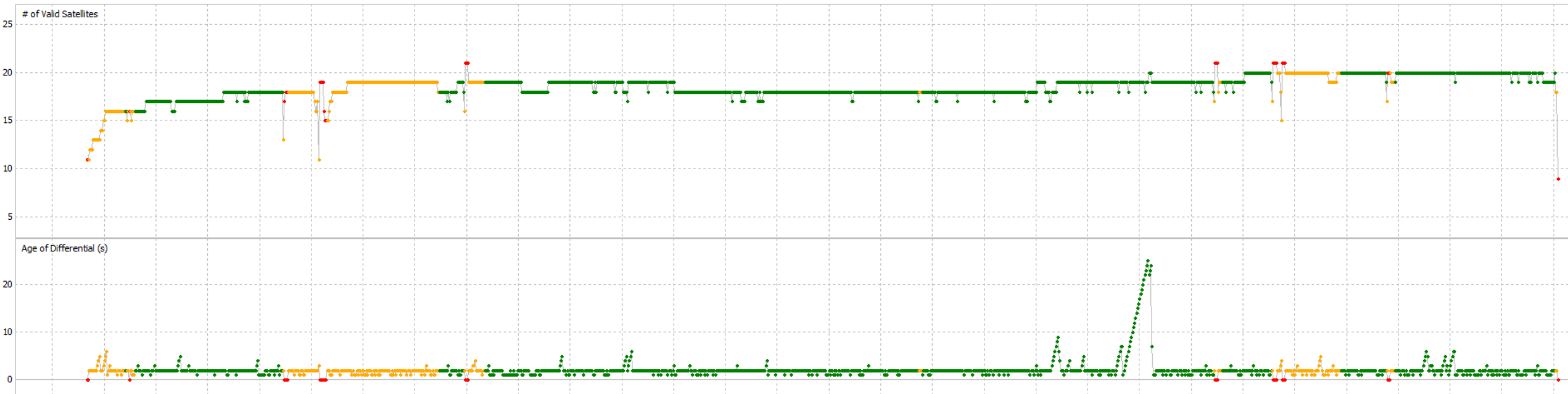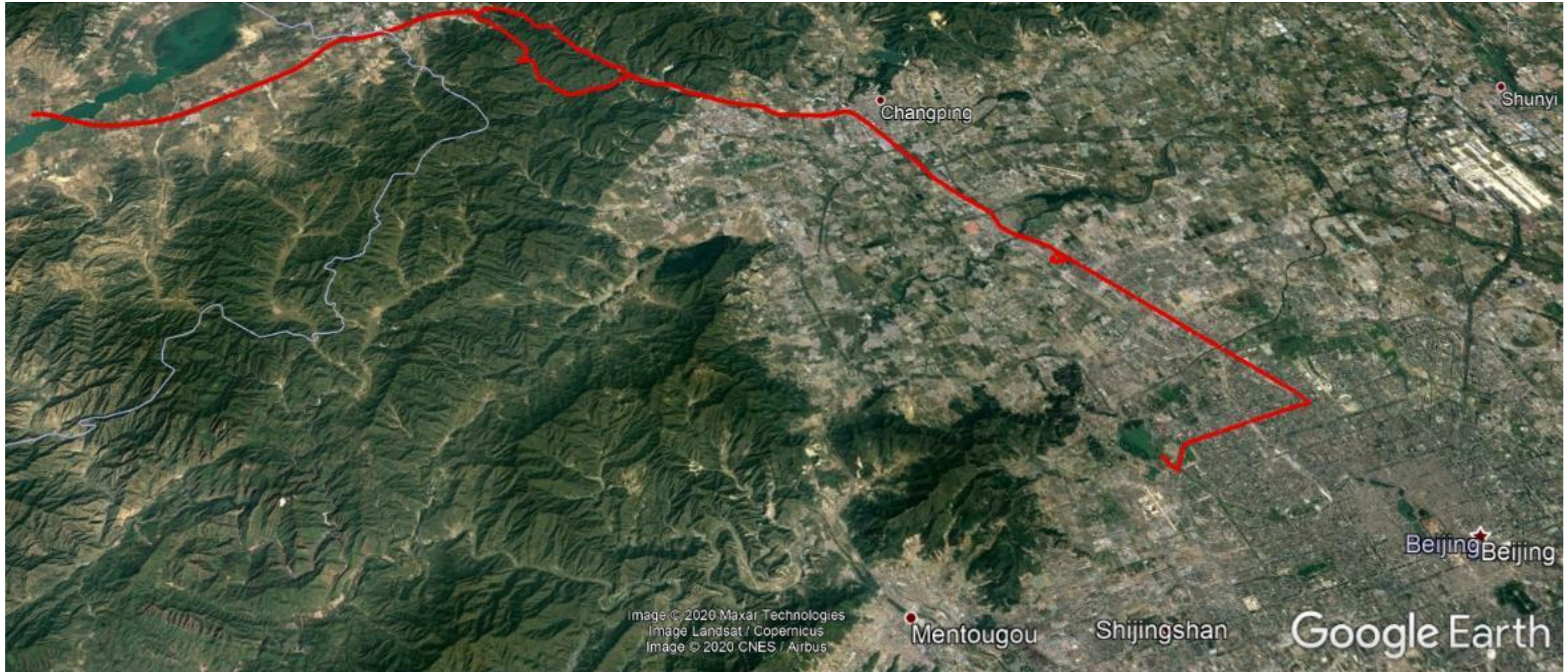| Rec	Fix rate
Allystar	78.61%
Comp1	77.41%

Shenzhen test 2 – high reliability mode

Rec	Fix rate
Allystar	75.93%
Comp1	77.41%

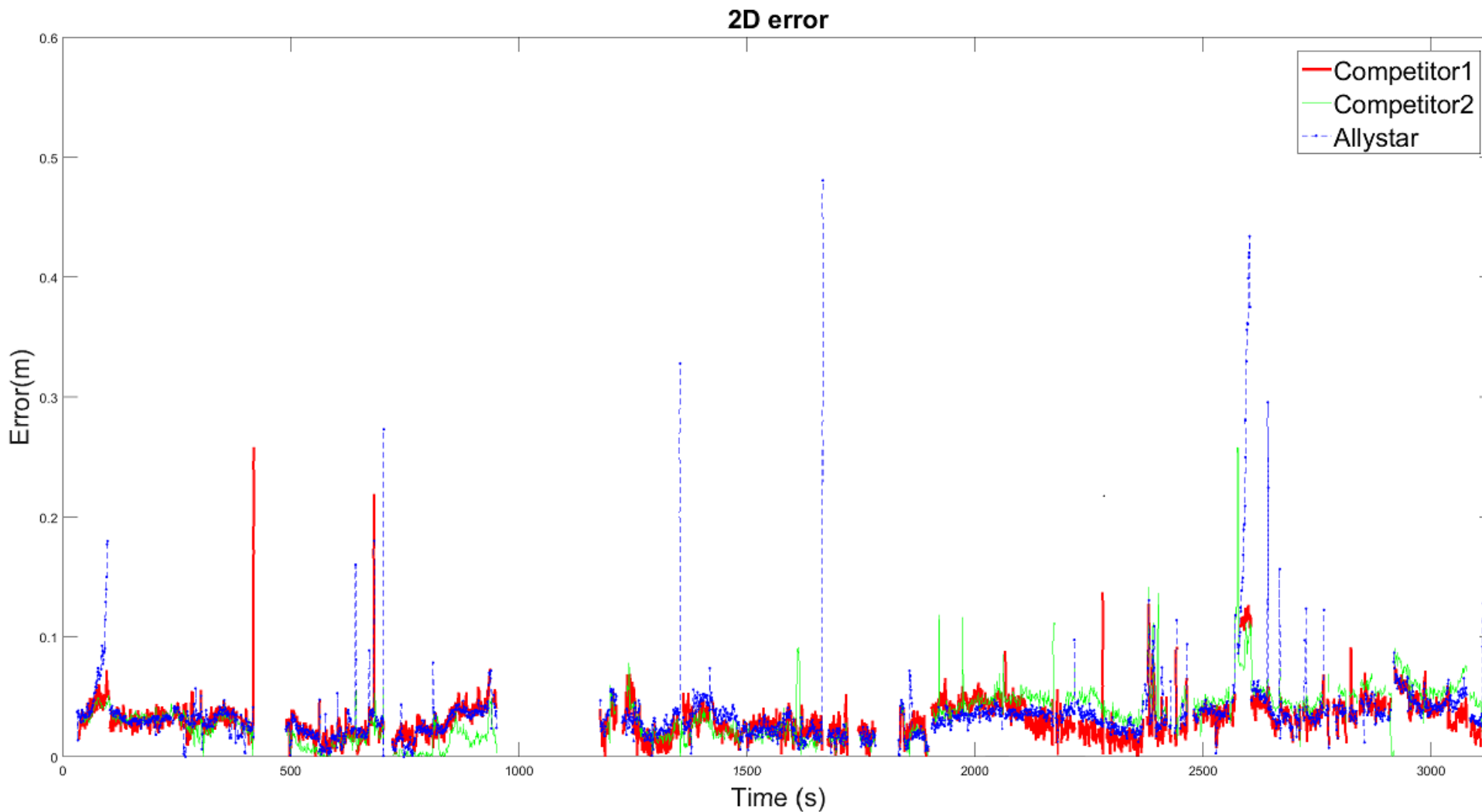# Shenzhen test 2- valid satellite count and correction age

- Green = RTK fixed solution
- Yellow = RTK float solution
- Red = Uncorrected solution (PVT)

Beijing test route
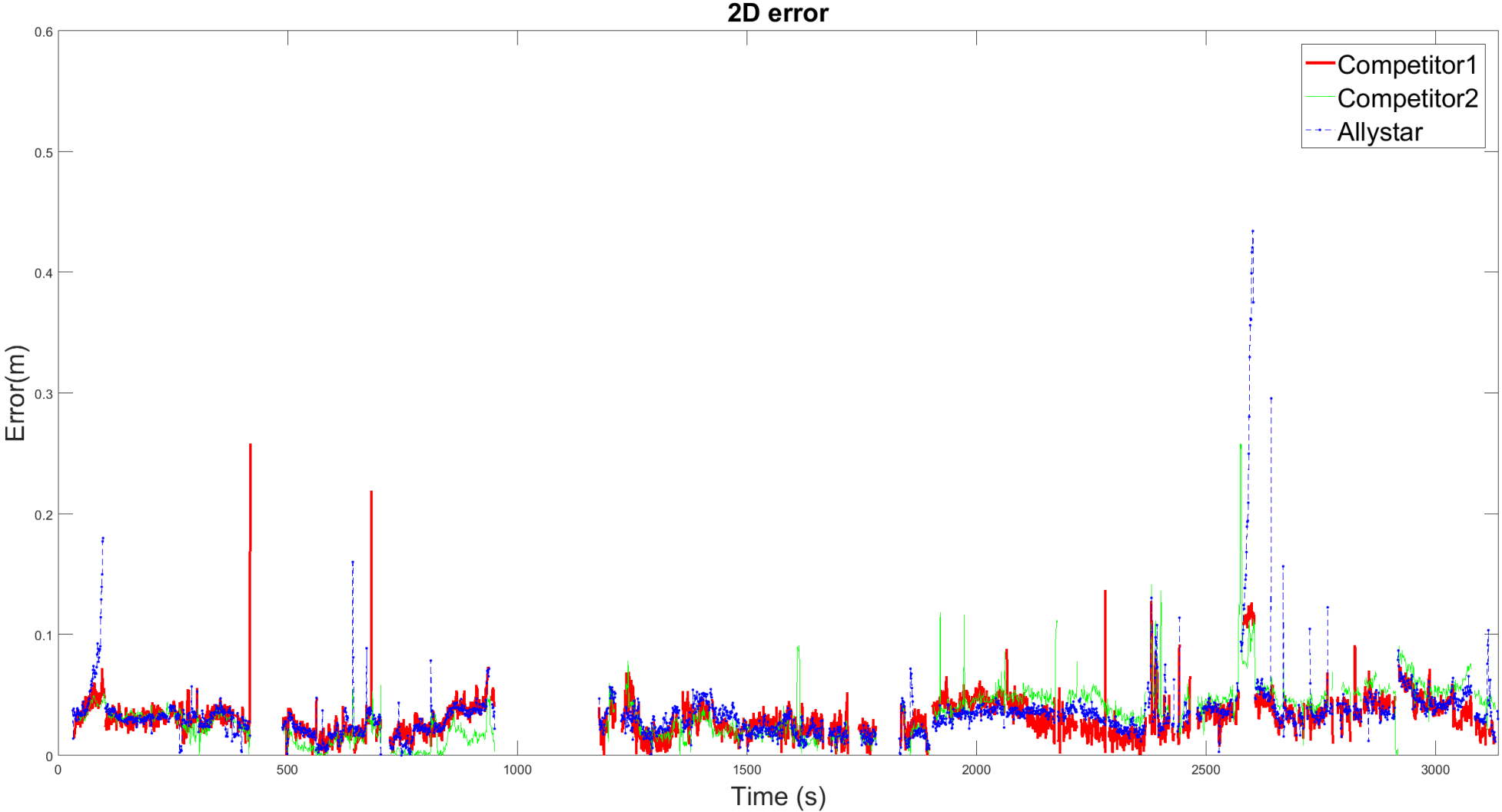
Use GPS L1/L2 and BeiDou B1I/B2I
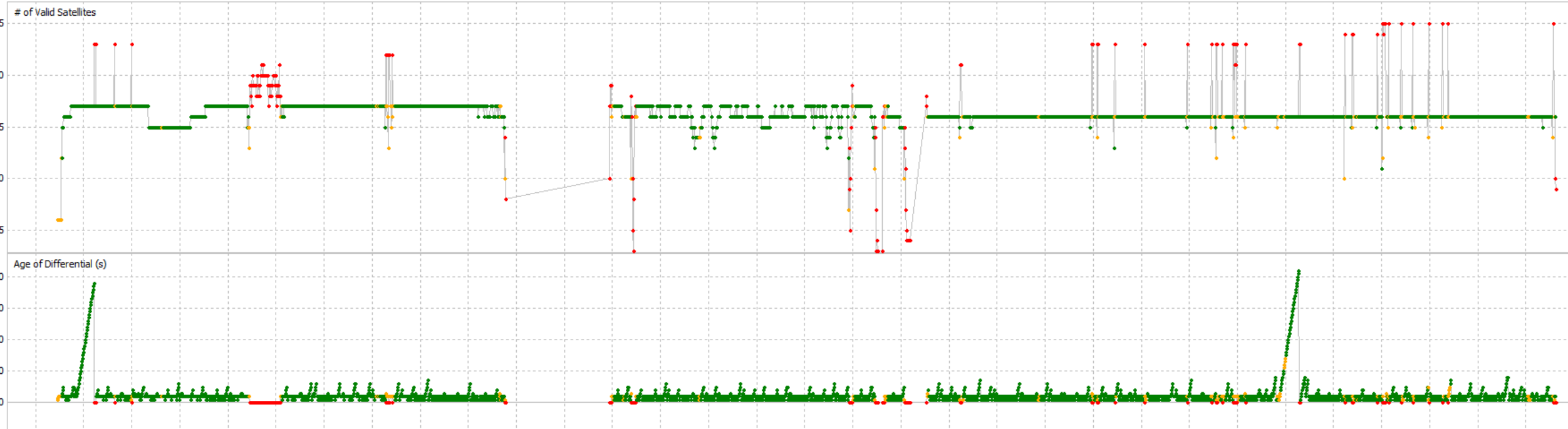
Beijing test – high availability mode

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2D error

Rec	Fix rate
Allystar	88.21%
Comp1	85.74%
Comp2	87.58%

Beijing test – high reliability mode

2D error

Rec	Fix rate
Allystar	86.34%
Comp1	85.74%
Comp2	87.58%

Beijing test – valid satellite count and correction age


- Green = RTK fixed solution
- Yellow = RTK float solution
- Red = Uncorrected solution (PVT)

Summary

- Allystar RTK solution was introduced
  - Built-in RTK engine running on a small chip
  - Performance better or similar compared to competitors
  - First mass-marked RTK solution to support L5 band and BeiDou B2a signal

- Future improvements
  - New Allystar Cynosure 4 chip coming in near future
  - Transition to L5 band

THANK YOU

Visit us at: http://www.allystar.com/en/
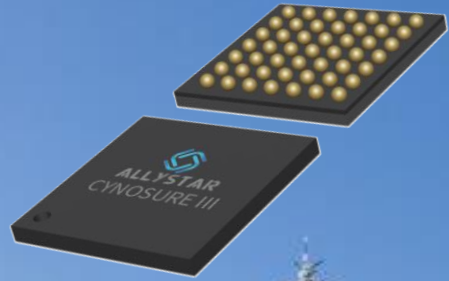
EMAIL: info@allystar.com
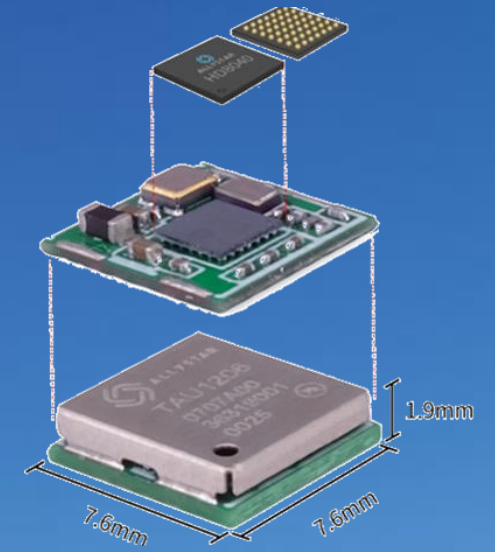
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Seeking for GNSS partners!