

Septentrio AsteRx-m2a UAS Reference Guide



Contents

1. Feature of Receiver
2. Usage Example
3. Evaluation (RTK)
4. Evaluation (Compass)
5. Experiment of AIM+ (Anti-jamming)

1. Feature of Receiver

◆ Constellation and signal

GPS	L1C/A, L2P(Y), L2C
GLONASS	G1C/A, G2C/A
Beidou	B1I, B2I
Galileo	E1B, E5b
SBAS	L1C/A

◆ PVT type

RTK, GNSS compass, Moving Base RTK
DGNSS, SBAS, SPP

◆ Data I/O

Input: RTCMv2/v3, CMR

Output: NMEA, SBF, RTCMv2/v3, CMR

◆ Power supply

Receiver input: USB 5V or 6-30V DC

Antenna supply: 3.3-5V

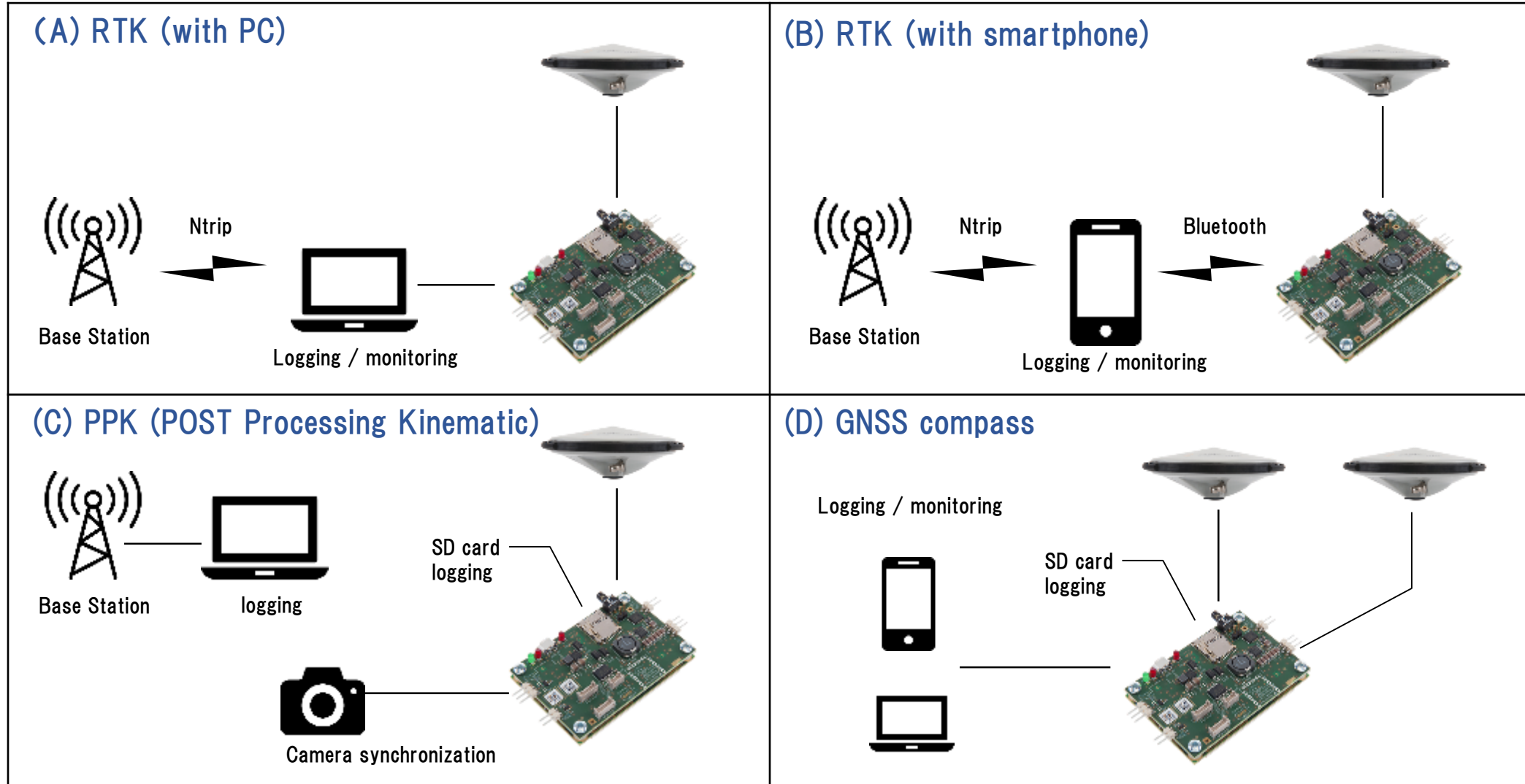
◆ Other

Anti-jamming

Camera shutter synchronization

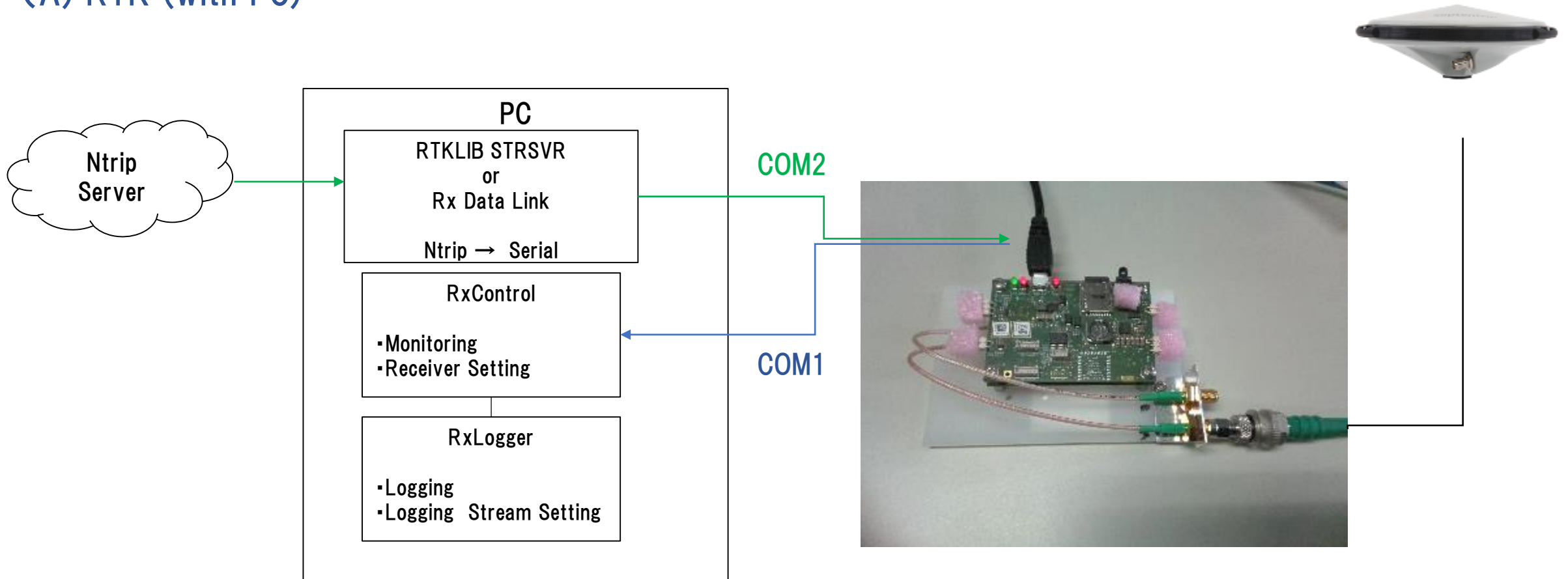
SD card logging

2. Usage Example



2. Usage Example

(A) RTK (with PC)



2. Usage Example

(A) RTK (with PC)

The screenshot displays three windows from the RTK software suite:

- Device Manager (左側):** Shows the connection of virtual COM ports. Red callouts point to:
 - COM1 of Receiver (Septentrio Virtual USB COM Port 1)
 - COM2 of Receiver (Septentrio Virtual USB COM Port 2)
 - RTCMv3 (NTRIP Client)
 - COM15 (Serial output)
- RxControl (中央):** Shows real-time receiver data:
 - Position Information:** Geodetic coordinates (φ: N 35° 39'59.45482", λ: E 139° 47'32.62581", h: +59.441m) and Base station coordinates (σ_φ: +0.008m, σ_λ: +0.004m, σ_h: +0.010m).
 - Satellite Status:** Grid of satellite lock indicators (G01-G12, G13-G24, G25-G32).
 - Receiver Status:** DOP (PDOP: 1.18, TDOP: 0.63, HDOP: 0.71, VDOP: 0.94), PVT (Mode: RTK Fixed (0)), and System (GPS+GLONASS+BeiDou).
- RxControl Logger (右側):** Shows logging configuration and data:
 - Status:** SBF Logging (Current File: log190422pc_1sbf (5.0 MB), 8.4 kBps) and NMEA Logging (Current File: log190422pc_1nmea (188.0 kB), 196 Bps).
 - Logger Info:** Table of logged messages:

Message	ID	Rev.	Occurrences
SBF			
NMEA			
GGA			981
RMC			981
VTG			981

2. Usage Example

(A) RTK (with PC)

The image displays three windows from the AsteRx-m2a software suite:

- Device Manager (左):** Shows the system tree with 'COM1 of Receiver' pointing to 'Septentrio Virtual USB COM Port 1 (COM14)' and 'COM2 of Receiver' pointing to 'Septentrio Virtual USB COM Port 2 (COM15)'.
- RxControl (中):** Shows real-time receiver data including Position Information (Geodetic: $\phi: N 35^\circ 39'59.45482''$, $\lambda: E 139^\circ 47'32.62581''$, $h: +59.441m$), Satellite Status (GPS, GLONASS, Galileo, BeiDou, SBAS, QZSS, IRNSS, L-Band), and Receiver Status (DOP: 1.18, PL: 0.63, RAIM: 0.71, VDT: 0.94).
- RxControl Logger (右):** Shows logging configuration and a table of logged messages.

Message	ID	Rev.	Occurrences
NMEA			
GGA			981
RMC			981
VTG			981

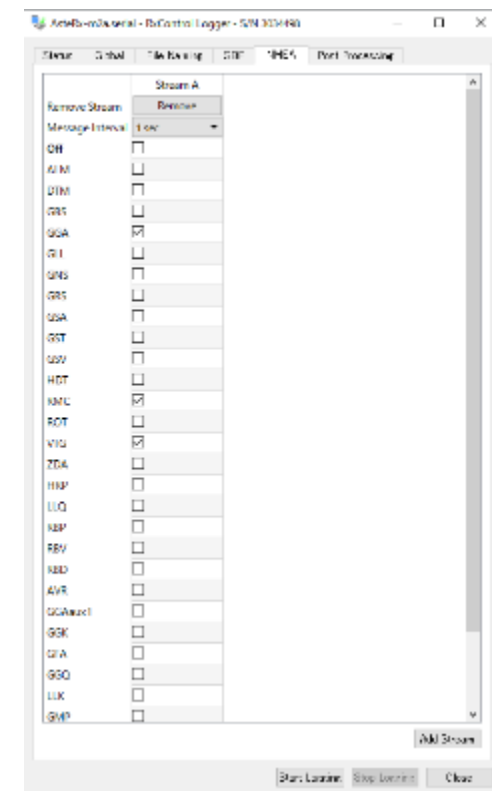
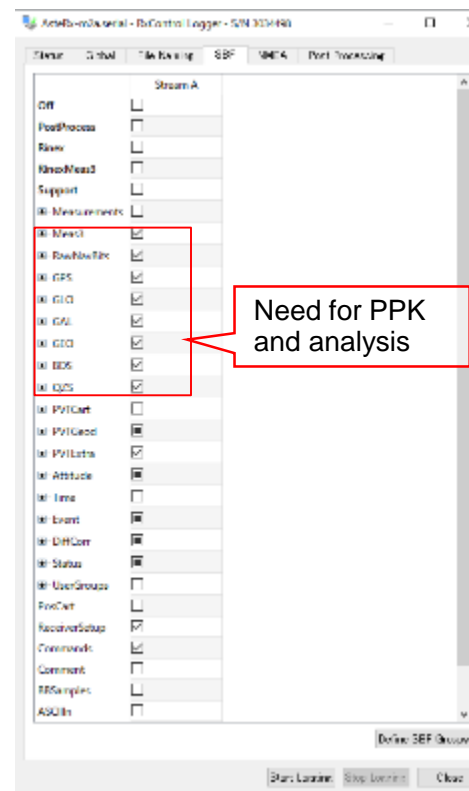
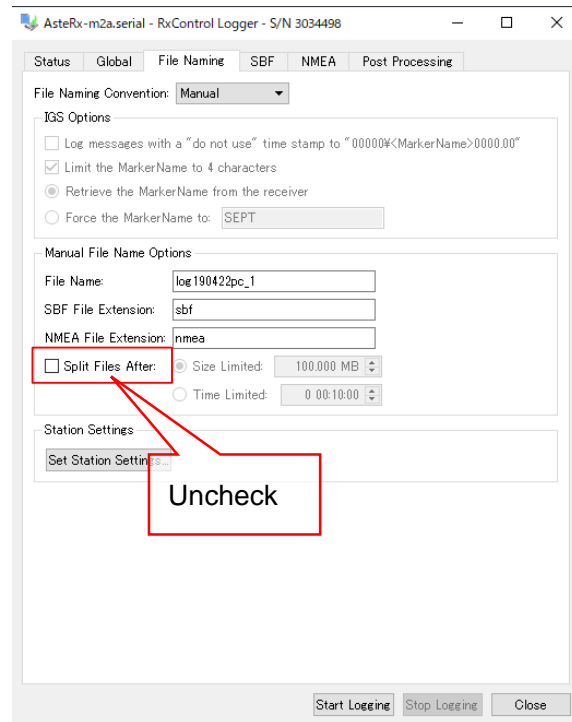
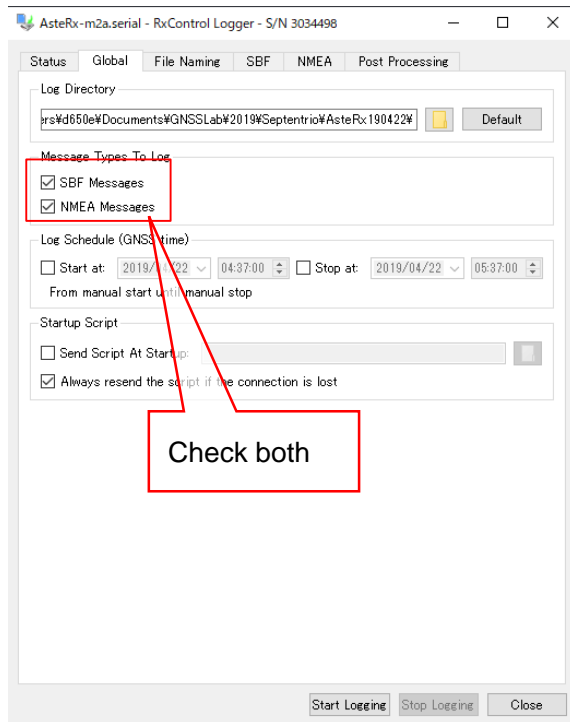
Rx Data Link (Bottom Left): Shows connection settings for two serial ports. Connection 1 is connected to COM17 at 127.0/0 kbps. Connection 2 is connected to COM17 at 00/12 kbps.

Log SBF & NMEA (Bottom Right): A callout box points to the logging configuration in the RxControl Logger window.

2. Usage Example

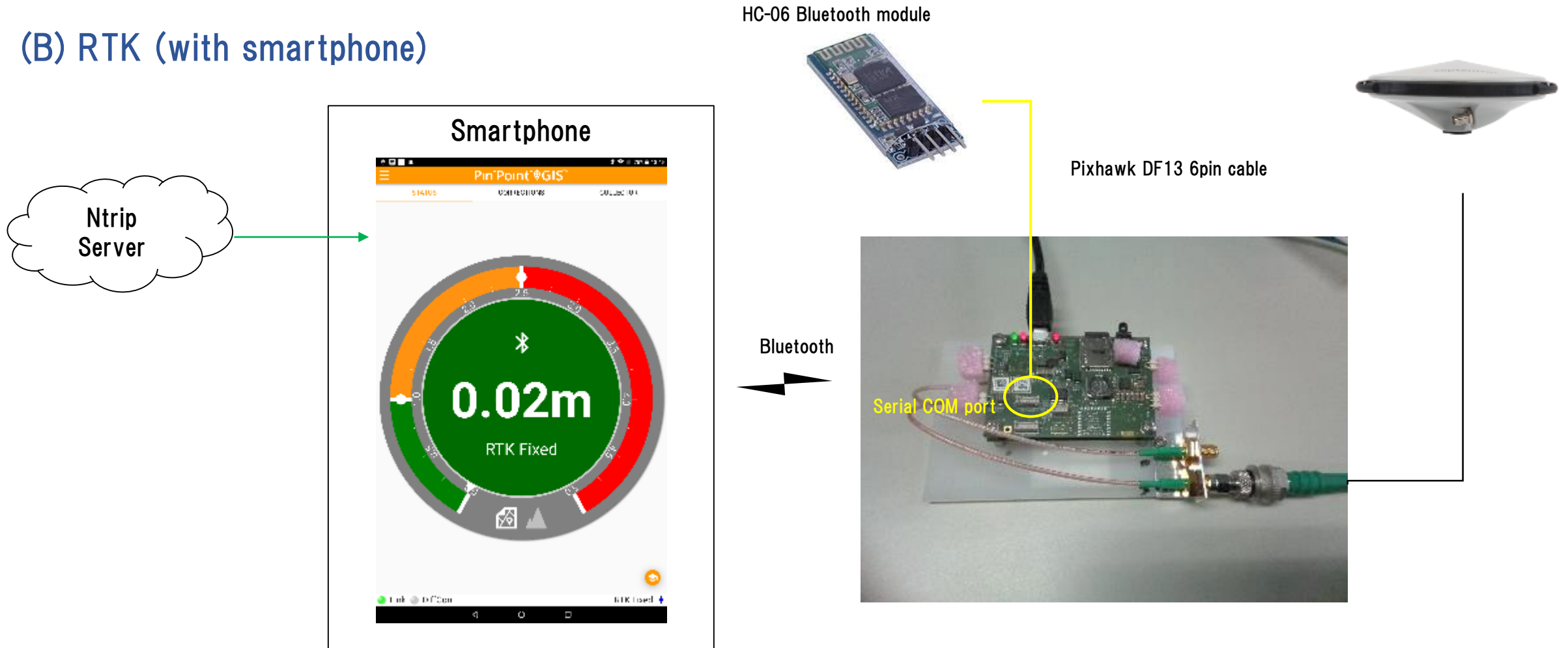
(A) RTK (with PC)

Example of Logger Setting



2. Usage Example

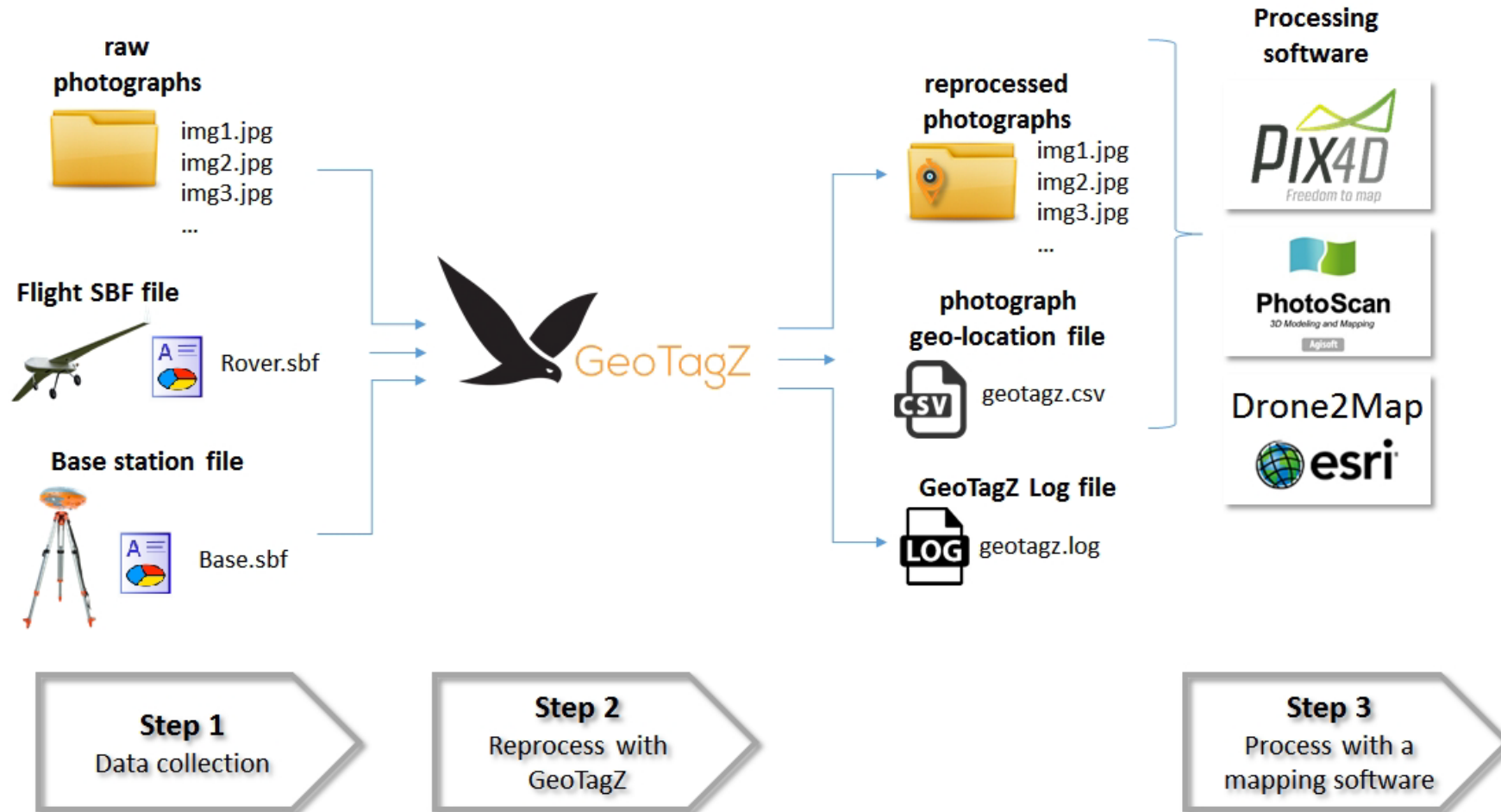
(B) RTK (with smartphone)



<https://play.google.com/store/apps/details?id=com.septentrio.pinpointgis&hl=ja>

2. Usage Example

(C) PPK (POST Processing Kinematic)



2. Usage Example

(C) PPK (POST Processing Kinematic)



Base Station & Logger (image)

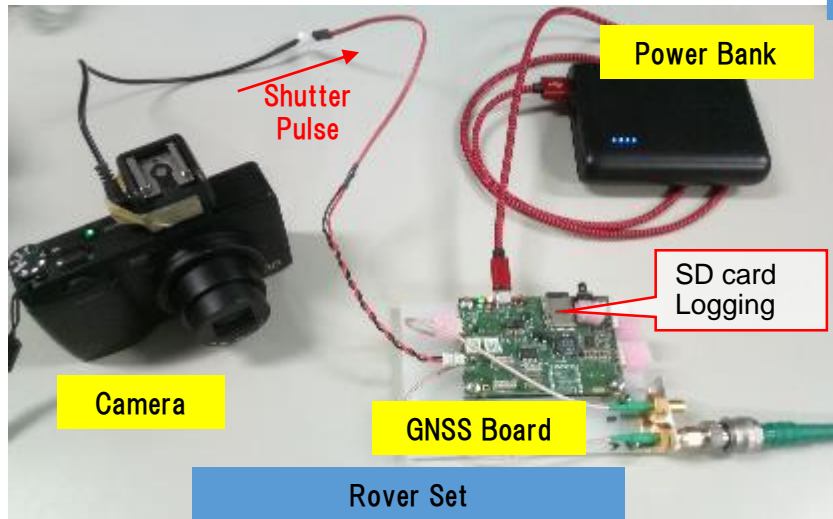
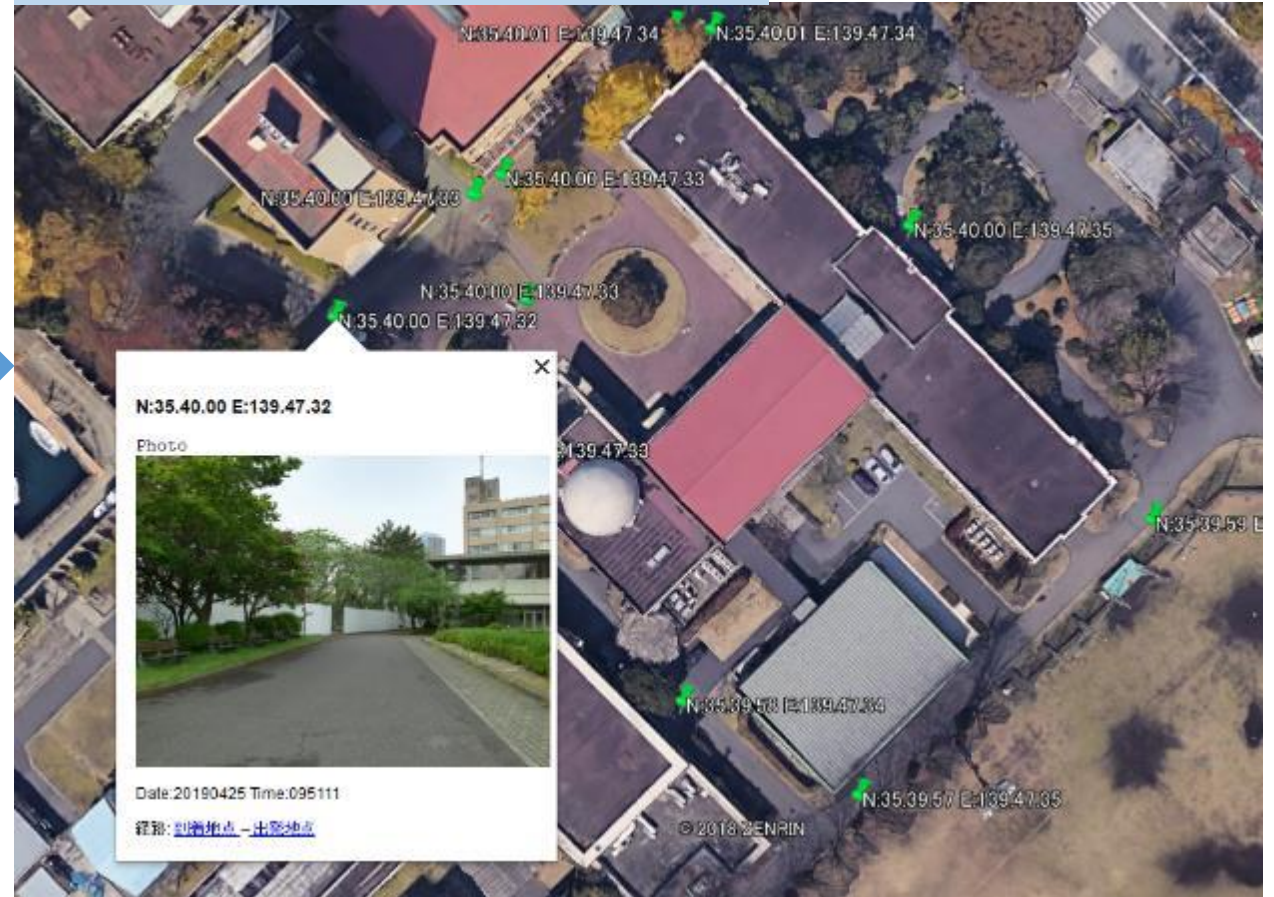


Photo with RTK position Geotag (Exif)



2. Usage Example

(C) PPK (POST Processing Kinematic)

Example of SD card log setting

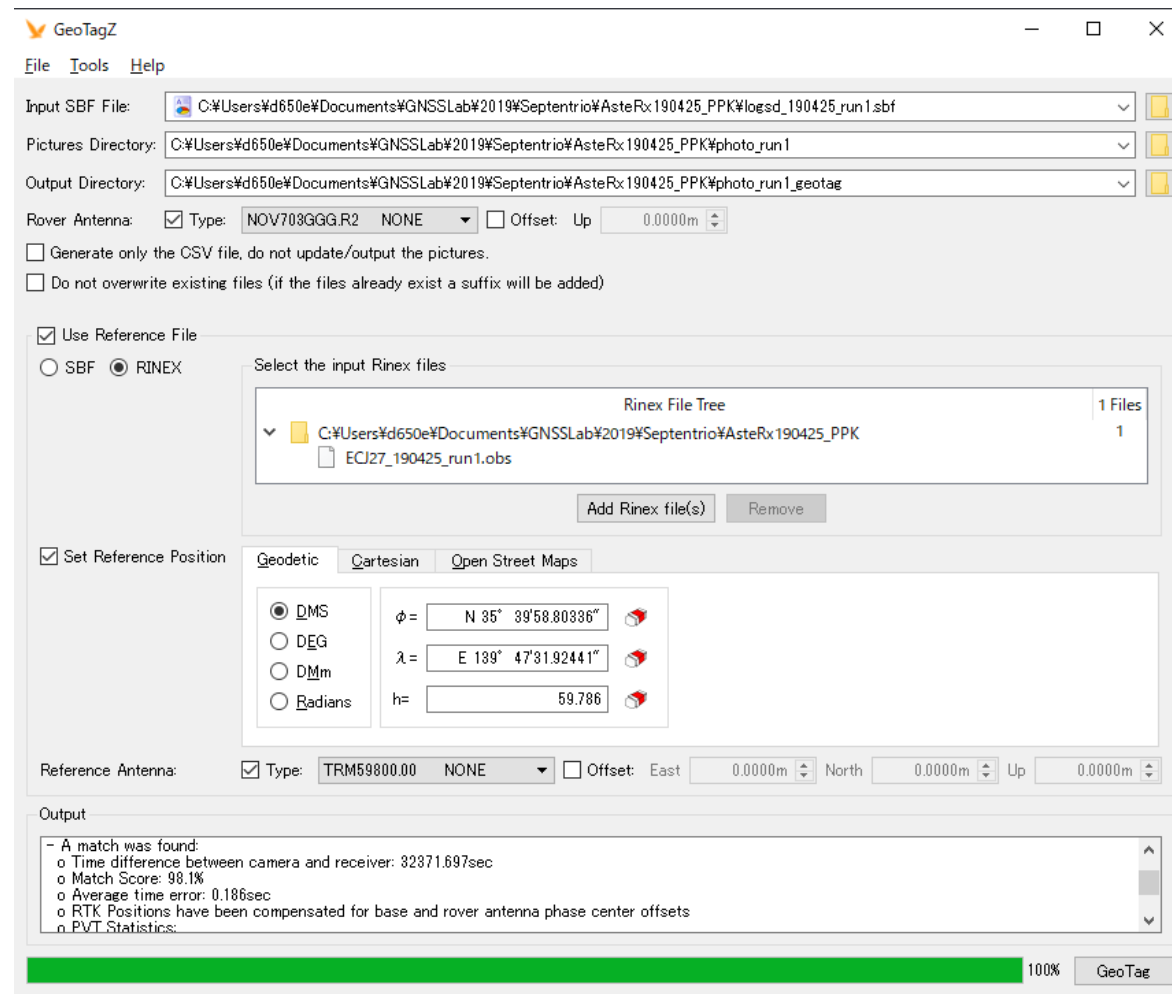
```
> setFileNaming,DSK1,Incremental,log //File name setting
> setNMEAOutput,Stream1,DSK1, +RMC+GGA+VTG+HDT+HRP, msec200 //add NMEA
stream
> setSBFOutput,Stream1,DSK1,+Rinex+Event, msec200 //add SBF stream
gno //Confirm NMEA stream
gso //Confirm SBF stream
> setDataInOut,DSK1, ,+SBF+NMEA //Log setting to SD card
exeCopyConfigFile,Current,Boot //Save configs to boot memory
```

Input Command

This setting enables that SD card logs SBF & NMEA at 5Hz with file name log_XXX automatically when power supplied. (// is comment)

2. Usage Example

(C) PPK (POST Processing Kinematic)

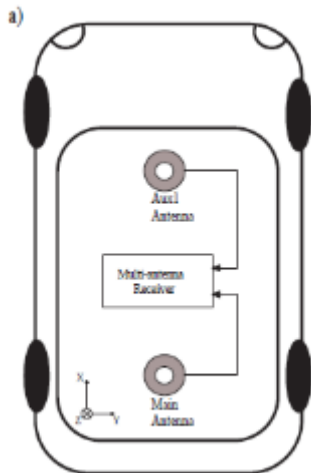


2. Usage Example

(D) GNSS compass

- ◆ Attitude information is supported by NMEA-HDT, NMEA-HRP or, SBF-Att messages.
- ◆ You can input antenna position offset from RxControl> Navigation> Positioning Mode>GNSS Attitude
- ◆ You can also run RTK by Main antenna during get attitude.

XYZ coordinate of attitude



Aux1 Antenna (B)

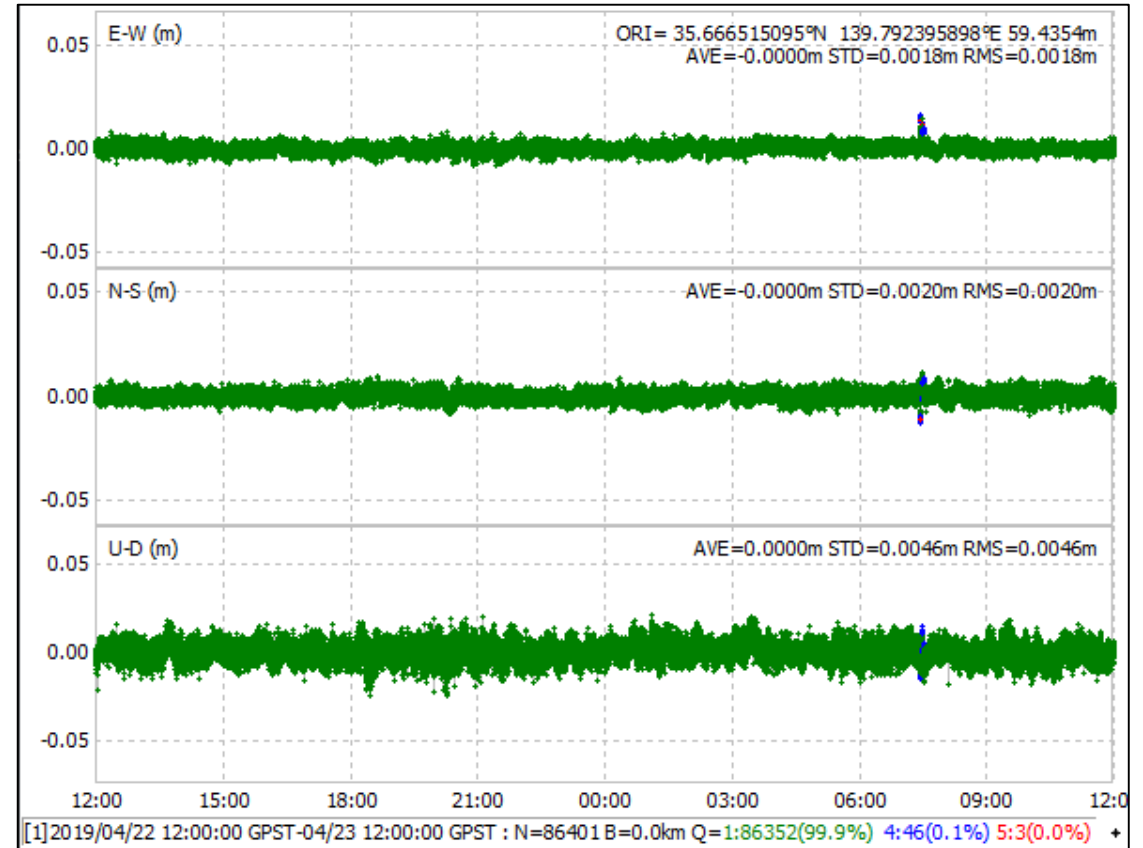
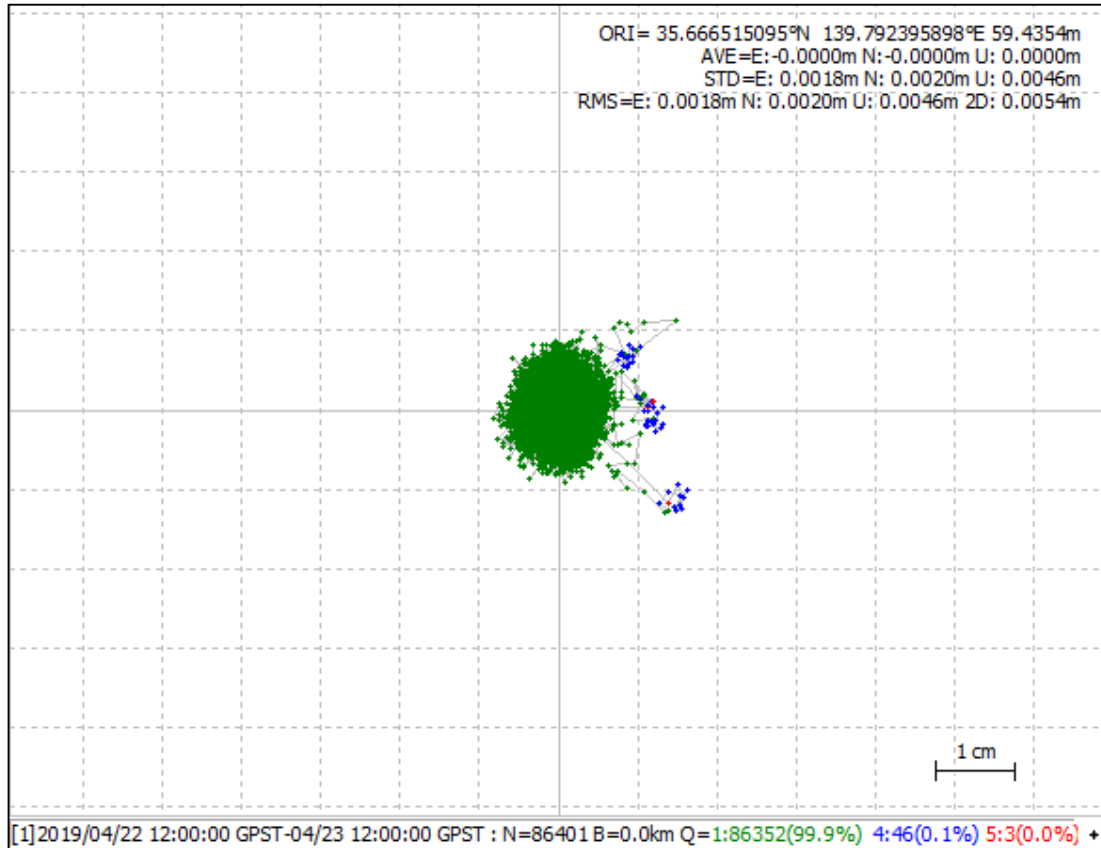
Main antenna (A)

3. Evaluation (RTK)

	Base	Rover (Static)
Receiver	Trimble net R9 (ECJ27)	Septentrio AsteRx-m2a
Antenna	Trimble Zephyr Geodetic2	Novatel GPS703-GGG
Constellation	GPS+GLONASS+Beidou+Galileo (Dual-Frequency)	
Time	GPST 2019/4/22 12:00~2019/4/23 12:00 (24h) , 1Hz	
Fix rate	99.9% (46 epoch of DGNSS and 3 epoch of SPP)	
RSME	Horizontal : 2.7mm / Height 4.6mm	

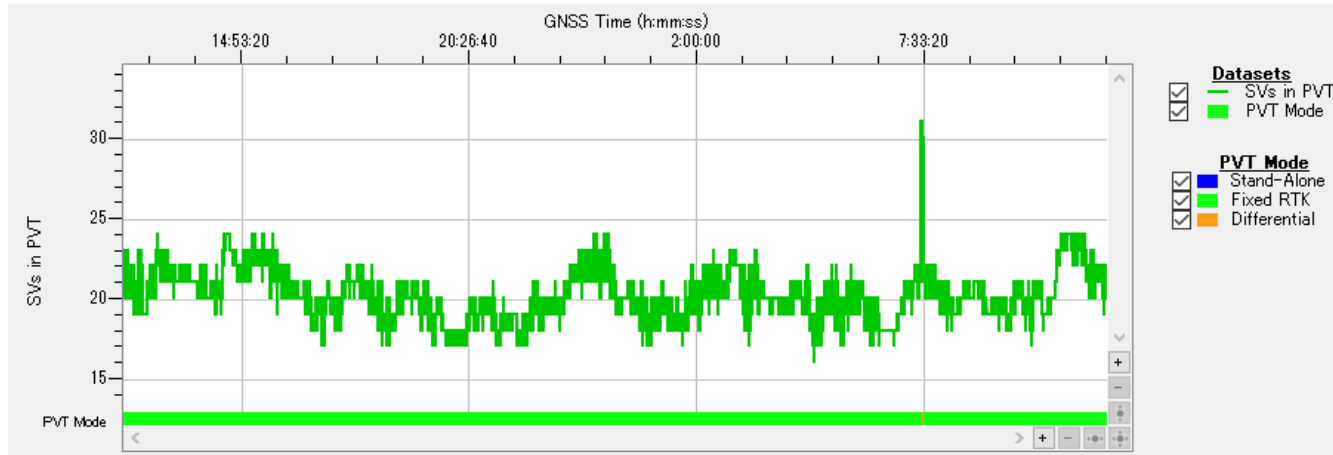
3. Evaluation (RTK)

Real time solution by receiver engine

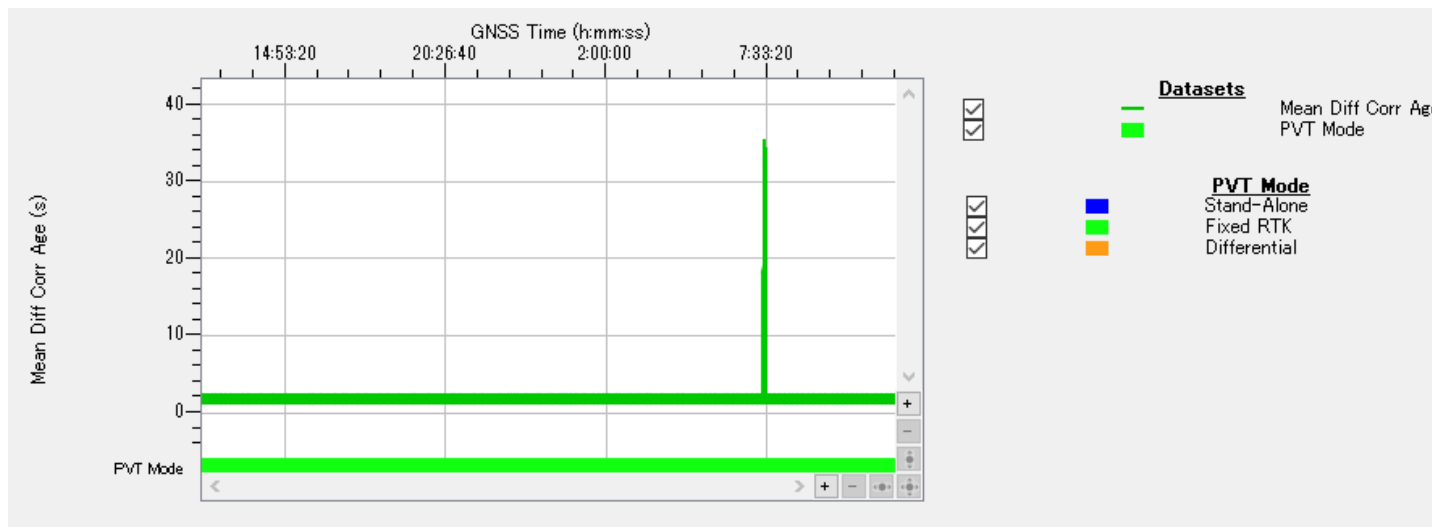


3. Evaluation (RTK)

Real time solution by receiver engine



Used satellites number is 17~ 24

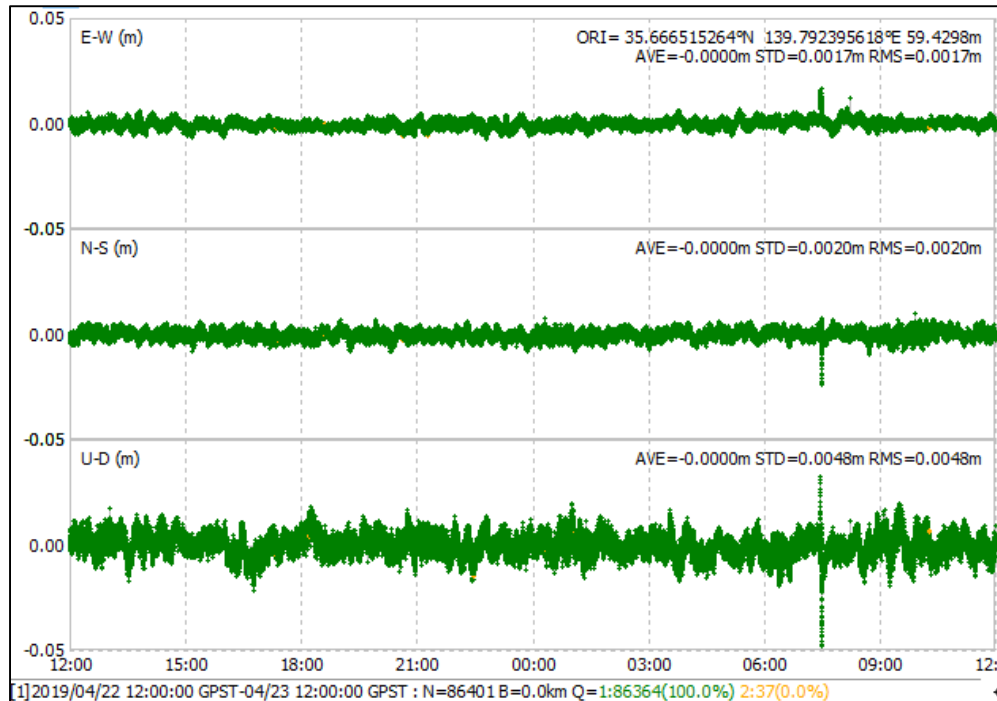


49 epoch of no Fix is because of delay of correction data stream.

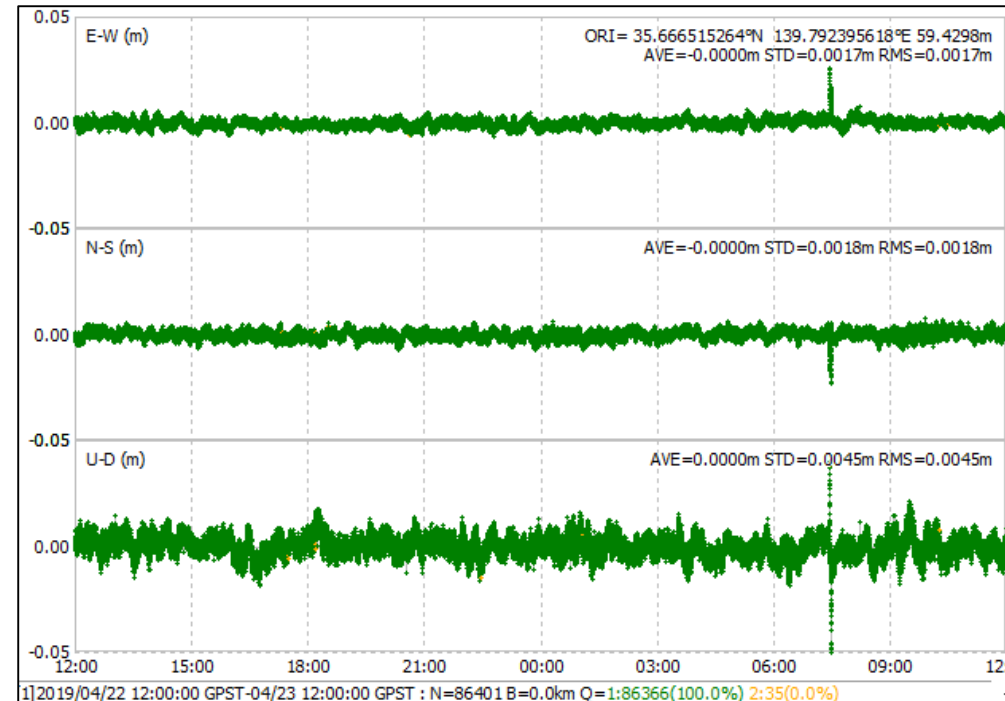
3. Evaluation (RTK)

Post processing by RTKLIB

It is considered that there is no IFB of GLONASS between Septentrio & Trimble



GPS+BDS+GAL



GPS+GLO+GAL

4. Evaluation (GNSS Compass)

Receiver	Septentrio AsteRx-m2a
Antenna	Novatel GPS703-GGG
Constellation	GPS+GLONASS+Beidou+Galileo (Dual-Frequency)
Time	GPST 2019/4/24 2:00~2:30 (30min) , 5Hz
Baseline	95.3cm
RSME	Heading: 0.042[deg]

4. Evaluation (GNSS Compass)



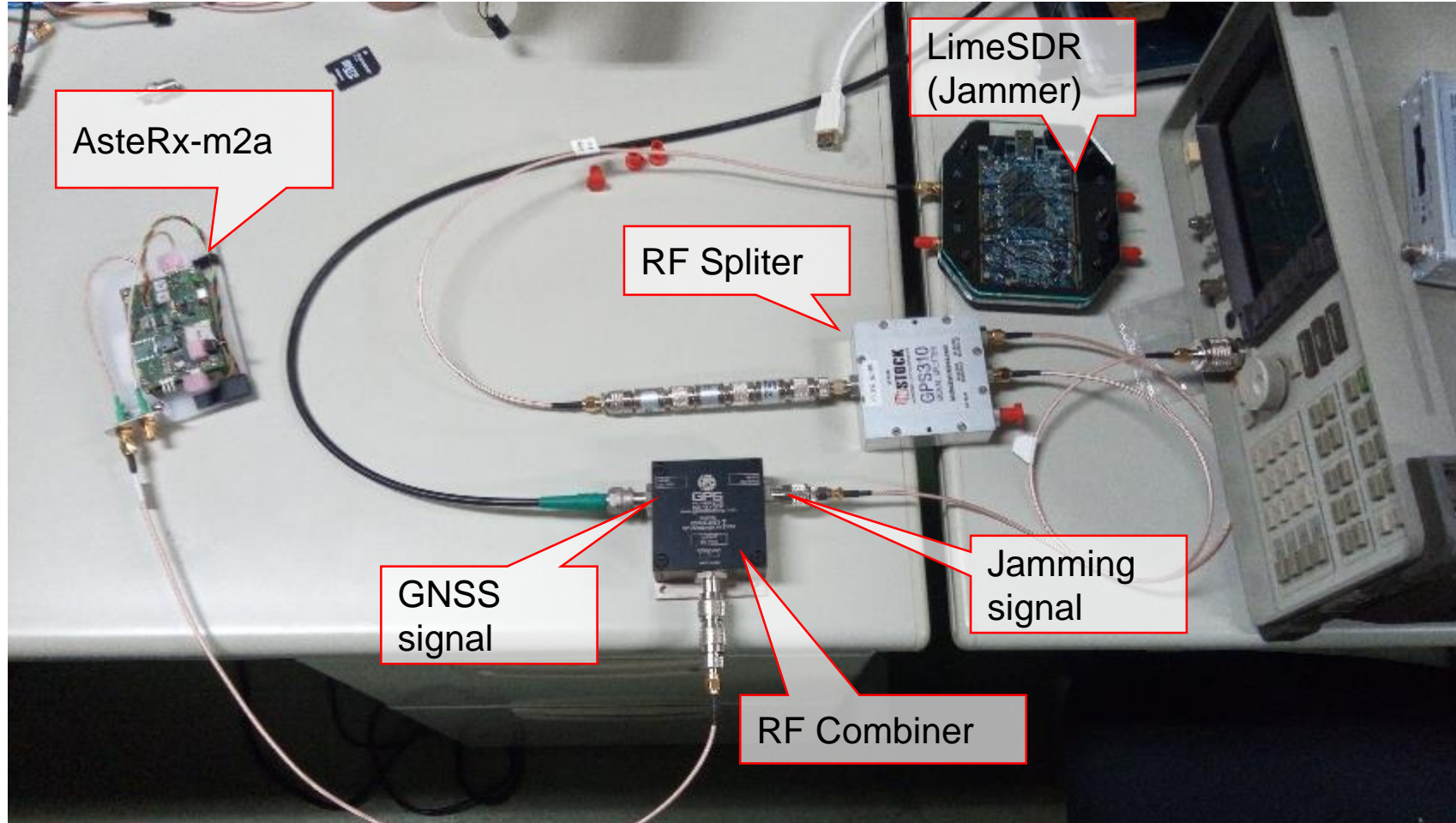
Baseline is static and true Heading=225.18[deg]

RMSE of Heading = 0.042[deg]

*True heading has ± 0.6 [deg] accuracy because it is calculated from RTK position of 2 antenna.
RTK position error will cause true heading error.

5. Experiment of AIM+

Test configuration



5. Experiment of AIM+

1. Narrow-band jamming (1575.42Mhz)

The screenshot displays the RTK software interface during a narrow-band jamming experiment. The main window shows the receiver's position and satellite status. The spectrum view window shows a sharp peak at 1575.42 MHz, indicating the jamming signal. The notch filter configuration window is open, showing settings for Notch1, Notch2, and Notch3, all set to 'off'. A yellow box at the bottom left of the screenshot contains the text "No Notch Filter".

- RTK → DGNSS
- GPS SNR down

5. Experiment of AIM+

1. Narrow-band jamming (1575.42Mhz)

The screenshot displays the AutoRx software interface with several key components:

- Position Information:** Shows coordinates (Latitude: 31° 38' 30.554433", Longitude: 113° 17' 23.526111") and elevation (+60.17m).
- Satellite Status:** Lists active satellites including GPS, GLONASS, Galileo, BeiDou, SBAS, QZSS, IRNSS, and L-Band.
- Receiver Status:** Displays various receiver parameters such as SBF, Status, DTMCorr, ExEvent, and ExStatus.
- Spectrum View:** A graph showing signal strength (Amplitude in dB) versus frequency (MHz). A red signal is visible around 1575 MHz, with a purple box highlighting a notch filter applied to it.
- Frontend and Interference Mitigation:** A settings window is open, showing notch filter configurations for Note1, Note2, and Note3. Note1 is set to 'auto' mode with a center frequency of 1,100,000 MHz and a double-sided bandwidth of 30 kHz.

- DGNSS → RTK Fix
- GPS SNR was recovered

Apply Notch Filter (auto)

5. Experiment of AIM+

1. Narrow-band jamming (1575.42Mhz)

The screenshot displays the AIM+ software interface with several key components:

- Position Information:** Shows coordinates (Latitude: 35° 11' 30" N, Longitude: 139° 47' 30" E) and altitude (+3.00m).
- GNSS Status:** A grid of icons representing various GNSS systems and their signal quality.
- Spectrum View:** A graph showing signal strength (Power Spectral Density) versus Frequency (MHz). A red line indicates the signal level, with a purple box highlighting a specific frequency band around 1575.42 MHz.
- Frontend and Interference Mitigation:** A panel on the right with settings for Notch Filters. The 'Mode' is set to 'manual', and the 'Center frequency' is set to 1,575.420 MHz.

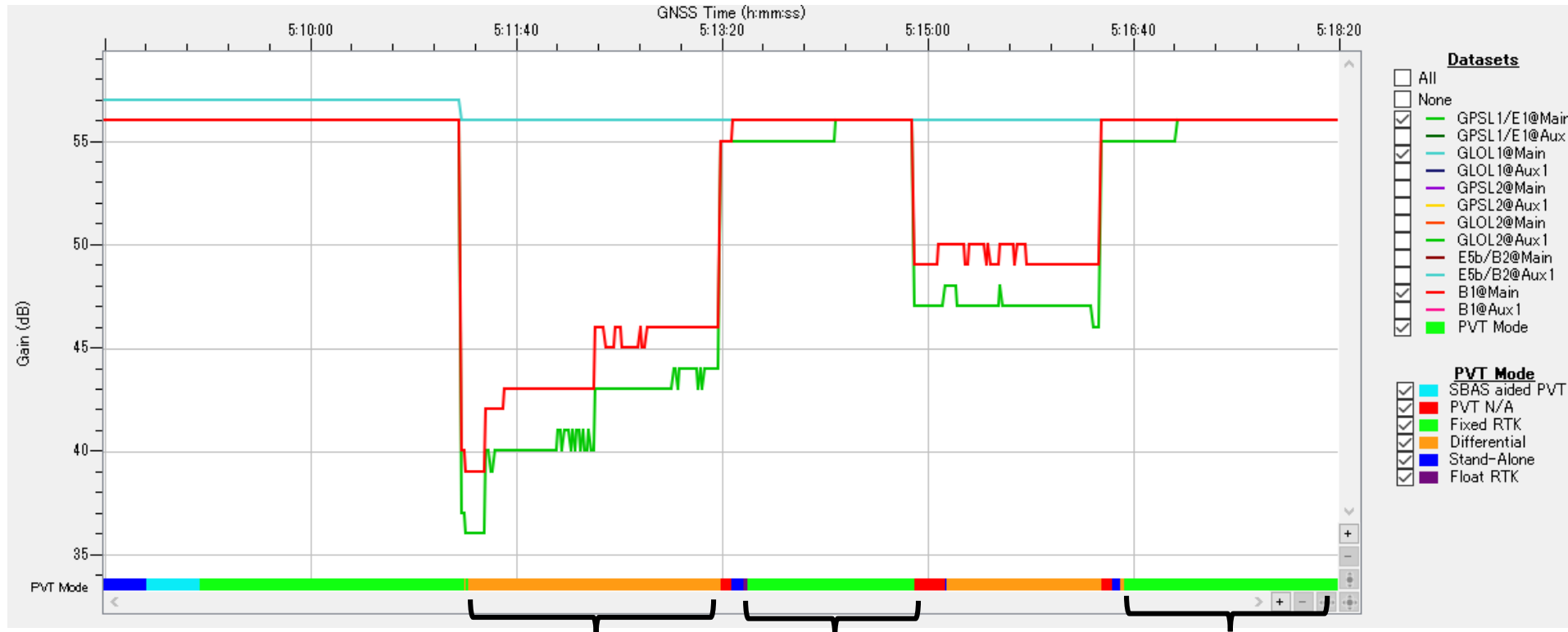
A yellow box at the bottom left of the screenshot contains the text: **Apply Notch Filter (manual)**

- No Fix → RTK fix
- GPS SNR was recovered

5. Experiment of AIM+

1. Narrow-band jamming (1575.42Mhz)

Frontend gain of L1 band



No Notch Filter

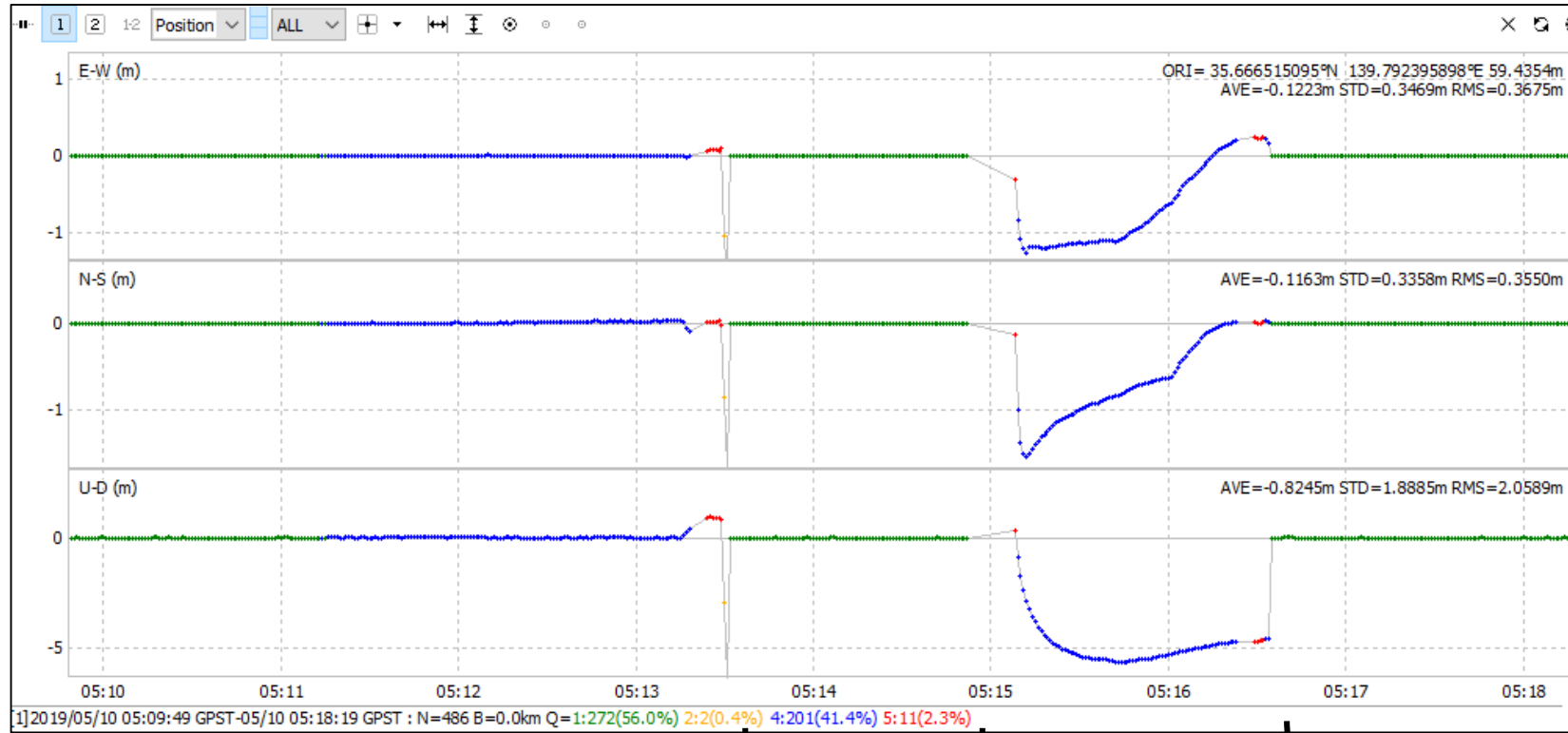
Notch Filter (auto)

Notch Filter (manual)

5. Experiment of AIM+

1. Narrow-band jamming (1575.42Mhz)

Position Error



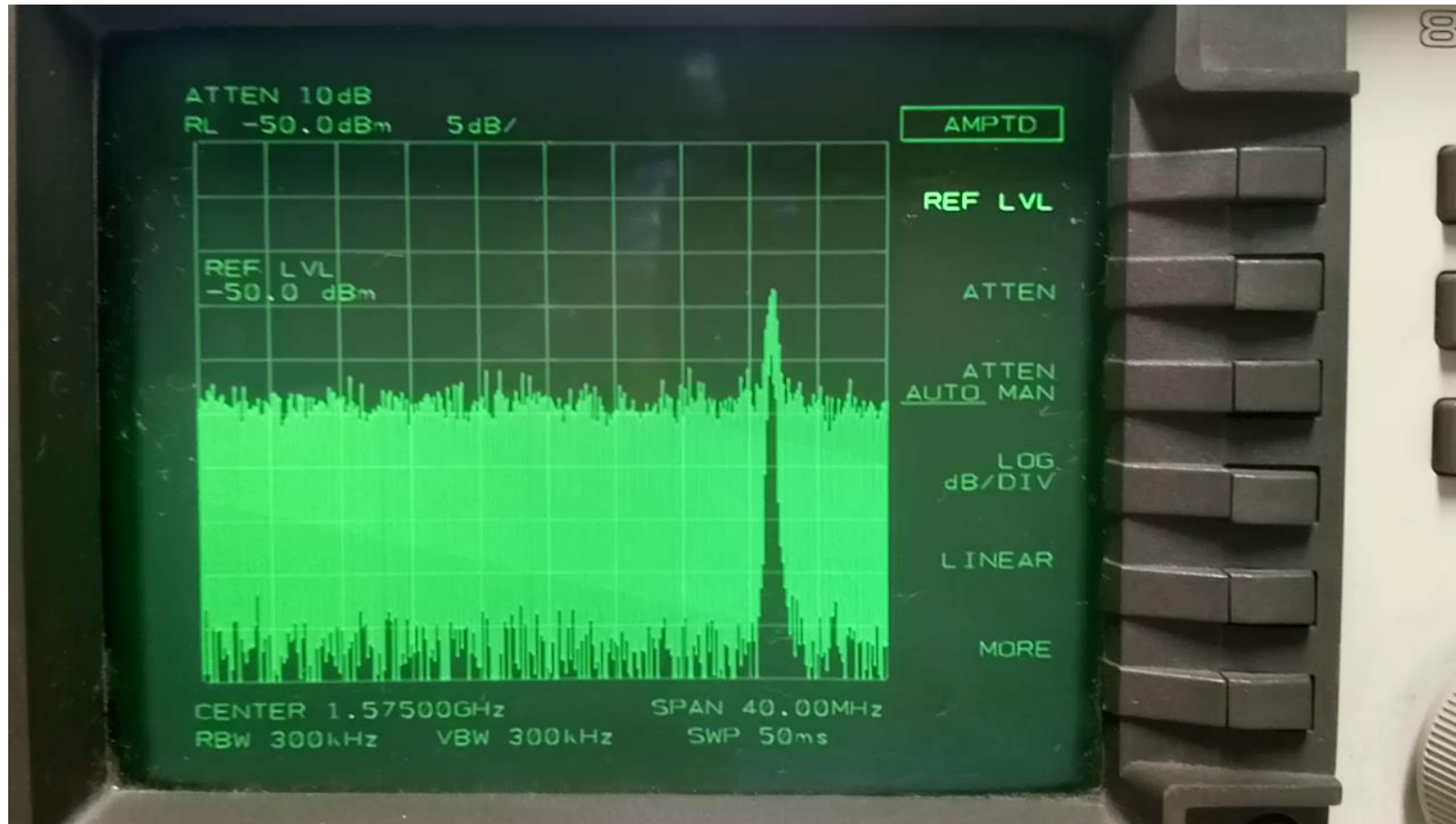
No Notch Filter

Notch Filter (auto)

Notch Filter (manual)

5. Experiment of AIM+

3. Chirp jamming (1560~1590MHz), "pulse, 100msec sweep "



5. Experiment of AIM+

3. Chirp jamming (1560~1590MHz), "pulse, 100msec sweep "

The screenshot displays the RTKMS software interface. On the left, the 'Position Information' panel shows coordinates and satellite status. The 'Spectrum View' window in the center shows a chirp jamming signal between 1560 and 1590 MHz. The 'RTK Status' window at the bottom right shows the RTK mode as 'Float'. A yellow box highlights the 'Track: Main' section in the satellite status panel, which is currently empty, indicating a loss of lock. A yellow banner at the bottom left reads 'No Wide Band Interference mitigation'.

- RTK → Float
- SVn down
- SNR down

5. Experiment of AIM+

3. Chirp jamming (1560~1590MHz), "pulse, 100msec sweep "

The screenshot displays the RTKLIB software interface with several windows open:

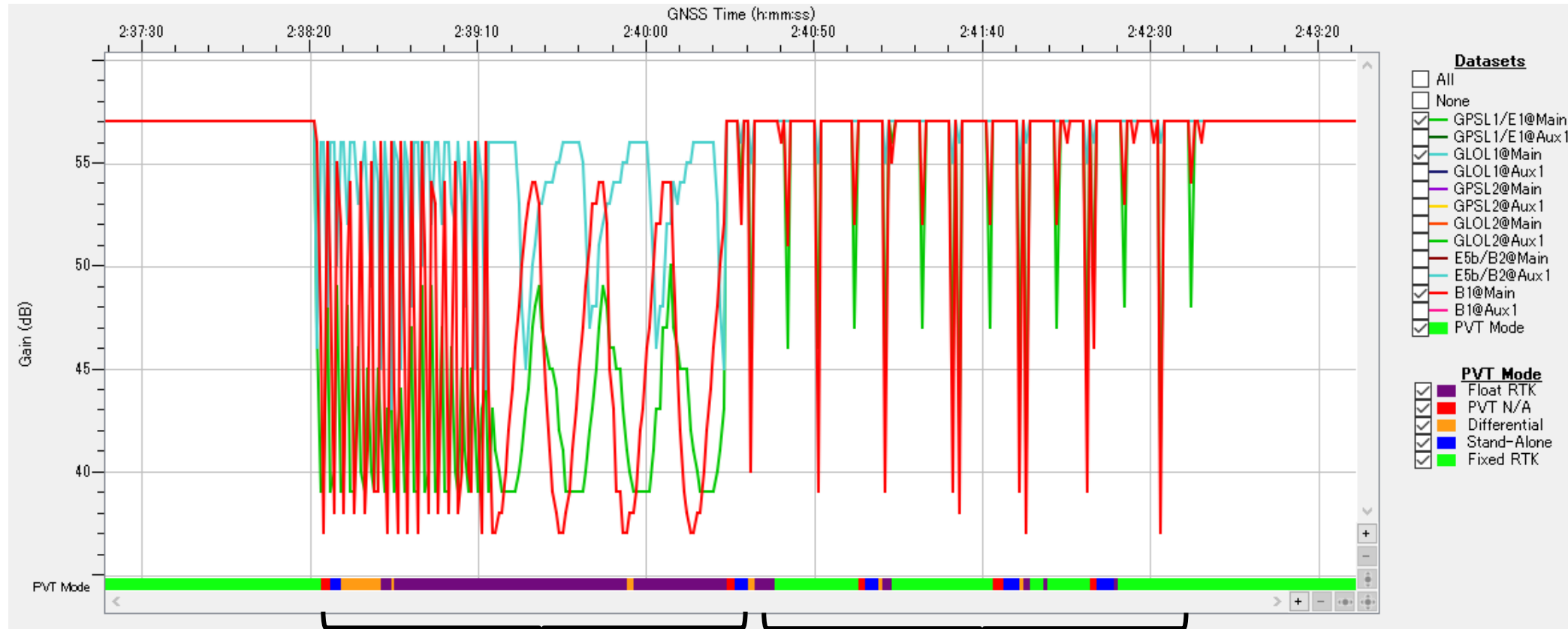
- Position Information:** Shows coordinates for Center (E: 135.34751947, N: 4780.3082, h: 49.483m) and Base station (E: 135.34751947, N: 4780.3082, h: 49.483m).
- Signal Status:** A table showing signal reception for various satellites. A red box highlights the 'Track' column for GPS satellites.
- Spectrum View:** A graph showing Power (dB) vs Frequency (MHz) with a prominent red signal between 1560 and 1590 MHz.
- Control and Interference Mitigation:** A dialog box with 'Wide Band Interference Mitigation' checked. The 'Notch Filter' section shows three notches set to 'off'.
- Wide Band Interference Mitigation:** A yellow box at the bottom left highlights this option.

- Float → RTK Fix
- SVn was recovered
- SNR was recovered

5. Experiment of AIM+

3. Chirp jamming (1560~1590MHz), "pulse, 100msec sweep "

Frontend gain of L1 band



No WBI mitigation

Apply WBI mitigation

5. Experiment of AIM+

3. Chirp jamming (1560~1590MHz), "pulse, 100msec sweep "

C/N ratio

