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A. Introduction

SatRef GNSS Data Automatic Computation Service (AutoComp) aims to provide convenient, fast and easy to understand GNSS static survey computation services to survey colleagues in Hong Kong. AutoComp complies with the requirements of [Specifications and Practice Guide for Establishing GPS Control Stations for Land Boundary Surveys Version 2.0](#) (LBS GPS Spec), which is adopted in the [Fourth Edition \(Revised\) of Code of Practice \(COPv4\) of Land Survey Ordinance \(Chapter 473\)](#) .

AutoComp was first developed on LEICA Geo Office (LGO) 7.0 with GPS only. In June 2012, AutoComp was running on LGO 8.2 with GPS and GLONASS options. Since Nov 2012, AutoComp was running on LGO 8.3 and further supporting RINEX Version 3.01 in May 2013.

B. Specifications

The LBS GPS Spec has two parts,

- Part I (**Specifications**) states the mandatory requirements in accuracy standard and quality requirements for establishing GPS control stations for land boundary surveys;
- Part II (**Practice Guide**) sets out the recommended practice for survey staff of the Survey and Mapping Office, Lands Department in establishing GPS control stations and maintaining survey records for quality checking.

The following table highlights the requirements of the LBS GPS Spec

No.	Requirement	Mandatory
1.	Accuracy Standard (10mm+3ppm) <ul style="list-style-type: none"> ● the standard error of any GPS baseline measurement shall not exceed σ, where $\sigma = \sqrt{[10^2 + (3 \times L)^2]} \text{ mm}$ or maximum 30mm (L = length of baseline in km) 	Yes
2	Checking Control Origin <ul style="list-style-type: none"> ● $dLat_{obs} - dLat_{comp} < 2\sigma$ ● $dLong_{obs} - dLong_{comp} < 2\sigma$ 	Yes
3	Control Station Connection <ul style="list-style-type: none"> ● at least three independent GPS baselines ● connected directly to at least two GPS control stations within 20 km 	Yes
4	Observation Sessions <ul style="list-style-type: none"> ● at least two observation sessions for each GPS baseline ● the time lapse at least 30 minutes at different times of day ● observation session at least 15 minutes ● no. of satellites ≥ 5 ● elevation mask ≥ 15 degrees ● epoch rate = 5 seconds ● GDOP < 5 	Yes Yes No No No No
5	GPS Baseline Processing <ul style="list-style-type: none"> ● integer ambiguity fixed solutions ● discrepancy of repeated baselines of dLat & dLong $< 2\sqrt{2}\sigma$ 	Yes
6	Least Squares Network Adjustment <ul style="list-style-type: none"> ● residuals of GPS baseline horizontal components (V_{Lat} & V_{Long}) $< 2\sigma$ 	Yes

C. User Operation

Please login SatRef Data Services <https://www.geodetic.gov.hk/smo/index.htm>

The screenshot shows a web browser window titled "Geodetic Survey of Hong Kong - Windows Internet Explorer" with the address bar displaying "https://www.geodetic.gov.hk/smo/index.htm". The page header includes the logo of the Survey and Mapping Office / Lands Department, the text "The Government of the Hong Kong Special Administrative Region", and the "HONG KONG" logo. A navigation bar contains "GovHK 香港政府一站通", language options "繁體版" and "简体版", a search box, and links for "SITE MAP" and an email icon. A left sidebar lists navigation items: "Lands Department Home", "SMO Home", "Geodetic Survey Home", "Geodetic Survey Products & Services", "FAQ", "What's new", "Contact us", and "About us". The main content area features a banner for "Survey and Mapping Office Lands Department" and a section titled "Geodetic Survey" with the subtitle "Hong Kong Satellite Positioning Reference Station Network (SatRef)". Below this is a "Data Services Login" form with fields for "User ID" and "Password", and "Login" and "Cancel" buttons. Links for "[New Registration]" and "[Forget password]" are provided. A note at the bottom states: "If you do not have a SatRef account, please apply a free account by clicking the above 'New Registration' button. Should you have any query, please feel free to [contact us](#)".

The screenshot shows a "Services" menu with a list of links. The link "GNSS Data Automatic Computation - Land Boundary Survey" is highlighted with a red rectangular box. The other links are "Download GNSS RINEX Data", "Network RTK or DGPS Services via NTRIP", "Change Password", and "Contact Us".

➤ Step 1 – Select RINEX Observation and Navigation Files

Geodetic Survey

Hong Kong Satellite Positioning Reference Station Network (SatRef)

Current User: Tai Man CHAN [[Back to Main](#)] | [[FAQ](#)] | [[Logout](#)]

GNSS Data Automatic Computation Service - LBS

- This automatic computation result is for reference purpose only. Different survey purposes have different survey specifications and requirements. Lands Department gives no guarantee regarding the correctness and completeness of this automatic computation and shall not be liable for any loss and damages arising from or related to the use of this automatic computation result. Please verify this automatic computation result before use.
- Please click [User Guide](#) for detail information.

Step 1: Please select the standard RINEX navigation file(s) and standard RINEX observation file(s) in the following input boxes:

*In box A1, B1 & C1, please input RINEX navigation files (i.e. *.11n)
In box A2, B2 & C2, please input RINEX observation files (i.e. *.11o)*

Notes:

- Maximum number of RINEX data files to be uploaded is 3 pairs.
- Each pair of RINEX files ('n' and 'o' files) contains only one unknown point's GNSS data.
- Each pair of RINEX files ('n' and 'o' files) contains only one observation session data.
- Total file size of RINEX data to be uploaded shall not be greater than 10MB.
- [NGS antenna](#) name must be used in the uploaded RINEX file.

A1 (Navigation file)

A2 (Observation file)

B1 (Navigation file)

B2 (Observation file)

C1 (Navigation file)

C2 (Observation file)

Although the web page requests you to select RINEX files in pair, i.e. a GPS navigation 'N' file and an observation 'O' file, however it is not necessary to upload navigation file (GPS 'N' file and GLONASS 'G' file) collected at rover location. It is because SatRef has collected navigation data that can be used in the computation. So, you can upload maximum 6 observation files (i.e. 6 individual sessions) [of the same unknown station](#) for computation.

➤ Step 2 – Select Reference Station if necessary

Step 2: Select the Reference Station (if necessary):

Select Reference Station sites manually

Please select the number of the nearest stations:

- HKSS - Shap Sze Heung
- HKWS - Wong Shek
- HKOH - Obelisk Hill
- HKPC - Peng Chau
- HKNP - Ngong Ping
- HKMW - Mui Wo
- HKFN - Fanling
- HKSL - Siu Lang Shui
- HKLT - Lam Tei
- HKKT - Kam Tin
- HKST - Shatin
- HKSC - Stonecutters Island

Un-tick the first checkbox (default) is to select the three nearest SatRef stations automatically as reference stations for computation. You can tick the first checkbox and to tick any number of SatRef reference stations manually. LBS GPS Spec requires a new station to be fixed by at least two reference stations. You are recommended to select 3 to 4 reference stations to provide sufficient baselines for network adjustment.

➤ Step 3 – Select Computation Precision

Step 3: Select the Computation Precision:

Please select the computation precision:

? **mm** : Please enter (mm)

? **ppm**: Please enter (ppm)

- 10 mm + 3 ppm
- 5 mm + 1 ppm
- 3 mm + 1 ppm
- ? mm + ? ppm
- ? mm

10mm+3ppm is required for Land Boundary Surveys. You can select 5mm+1ppm, 3mm+1ppm or enter any combination for other purposes. [See Tips \(T.4\)](#)

➤ Step 4 – Select Computation Settings

Step 4: Select the Computation and Other Setting:

Adopt Land Boundary Surveys (Code of Practice) Standard

- Allowable Maximum GDOP Value: (mins)
- Minimum Session: (session)
- Session Minimum Time Duration: (mins)
- Minimum Time Interval Between Sessions: (mins)
- Epoch Rate : (s)
- Elevation Mask : (degree)
- Require Check Origin :
- Maximum 1 Sigma (Accuracy Standard) : (mm)

Tick the checkbox (default) to adopt Land Boundary Surveys (Code of Practice) standard.

➤ Step 5 – Enter email address to receive result and Upload

Step 5: Please input your e-mail at the box below and click 'Upload' button to start the data processing. The processing result will be sent to you by e-mail.

Please input your e-mail:

* Using comma "," to separate between Email addresses if necessary.

You shall enter email addresses in this input box, use comma to separate multiple addresses. It also supports Lotus Notes personal email account of HKSAR Government users, e.g. ChanTai-man@hotmail.com, Tai Man CHAN/SMO/LANDSD/HKSARG@LANDSD
Acknowledgement email will be sent to the first email address only.

Lotus Notes group email account is **NOT** permitted, e.g. &LANDSD/SMO_GEOD/PSO/G

Remember to include @**department** in the Lotus Notes address if you are not staff of Lands Department, e.g. Tai Man CHAN/HD/HKSARG@HD

D. Acknowledgement Email

SatRef GNSS Automatic Computation Service - Acknowledgement



Geodetic-CA1 (geodetic@imail-hk.com) [Add to contacts](#) 6:03 PM

To: chantai-man@hotmail.com

The following files are received on 2013-06-12 18:03:00

1. KL2_AM0-1.12o 917 Kb
2. KL2_AM0-2.12o 833 Kb

Selected Options:

Computation Accuracy = 10mm+3ppm

Maximum Sigma = 30mm

Reference Station = Nearest 3

Minimum No. of Reference Station = 2

Minimum No. of Session = 2

Minimum Duration = 15 min.

Minimum Interval = 30 min.

Minimum No. of Baseline = 3

Maximum GDOP = 5.0

Epoch Rate = 5 sec.

Divide Observation file for every = N.A.

Land Boundary Survey Standard = True

Check Origin = True

Reject Large GDOP = True

Elevation Mask = 15 deg.

The data will be processed and the result will be sent to you shortly.

Thank you for choosing SatRef GNSS Automatic Computation Service.

Geodetic Survey Section

Survey and Mapping Office

Lands Department

E. Result Email

```
SatRef GNSS Automatic Computation Service - KL2
=====
Hong Kong Satellite Positioning Reference Station Network
GNSS Automatic Computation Service
=====

Applicant: Tai Man CHAN <ChanTai-man@hotmail.com>
<Tai Man CHAN/SMO/LANDSD/HKSARG>

Request: 2013-06-12 18:02:15 (HKT)
Process: 2013-06-12 18:04:07 (HKT)

New Station Name: KL2

Computation Accuracy: 10mm + 3ppm

Upload files: 1. KL2_AM0-1.12o 916Kb KL2 1.547m
2. KL2_AM0-2.12o 833Kb KL2 1.547m
```

The result emails are in plain texts, the contents are aligned with space. However most email software and webmail services ignore multiple spaces.

```
* automatic computation result. Please verify this automatic *
* computation result before use. *
* *
* * 1.22.000725 * * * * * * * * * * * * 2013-06-12 18:07:46 (HKT) * *

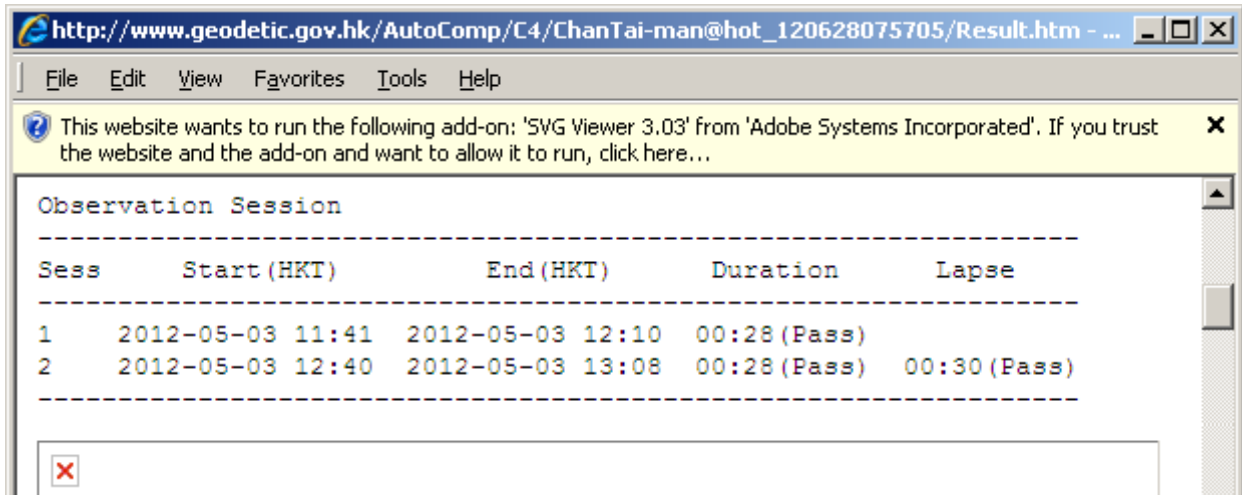
Remarks: Please click below links to get HTML result and full report.
The link is valid until 2013-08-12.

http://www.geodetic.gov.hk/AutoComp/C4/ChanTai-
man@hotmail\_130612\_180407/Result.htm
http://www.geodetic.gov.hk/AutoComp/C4/ChanTai-
man@hotmail\_130612\_180407/FullReport.zip
```

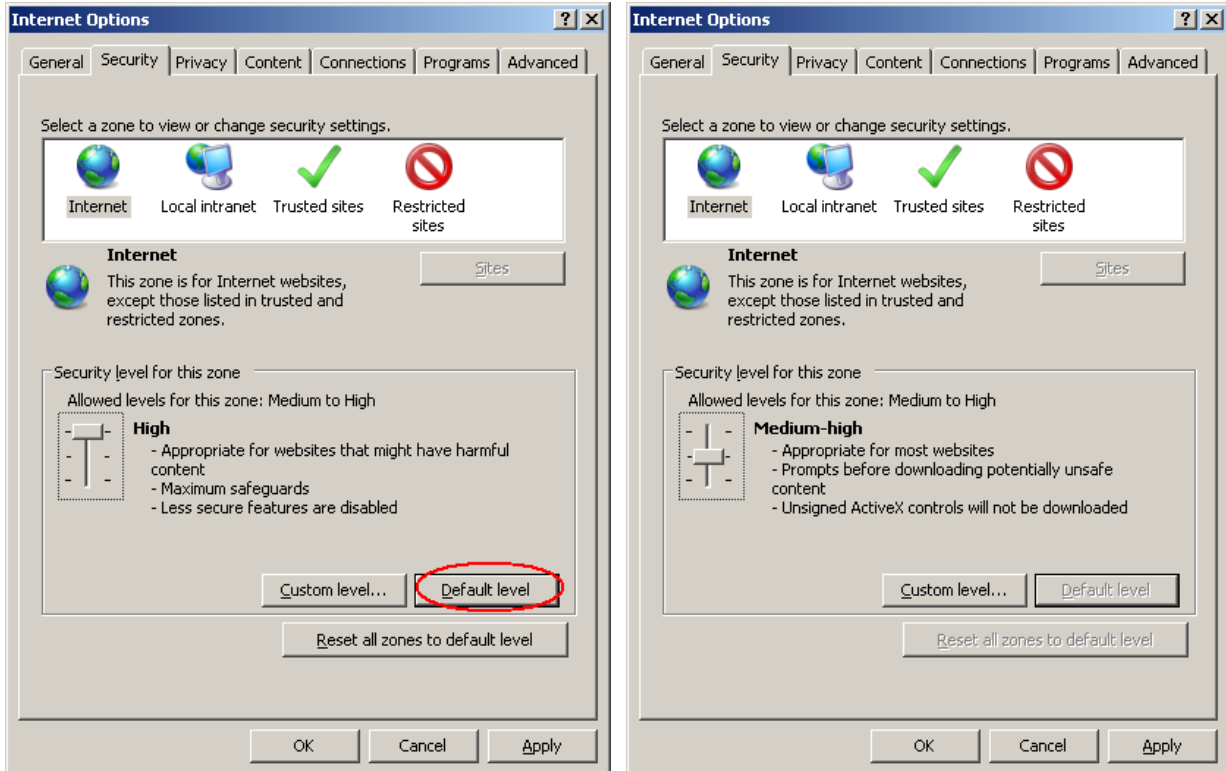
There are two URLs at the bottom of the result email. SatRef retains the computation result for 2 months. Result.htm (html file) is a color report and FullReport.zip (zip file) contains additional computation result files. Click the URL link to download and open FullReport.zip

F. Enable ActiveX to Show SVG Diagram

If your PC has been installed LGO, your PC would be installed Adobe SVG Viewer. Depending on your internet browser version, you may be prompted to run “SVG Viewer”. Please do so to enable the ActiveX in order to show SVG diagram.



If your browser security level is high, you will not see the chart or any warning message at all. Please change to Medium-high level and then enable the ActiveX to show diagram.



The Adobe SVG Viewer can be downloaded from the following webpage
<http://www.adobe.com/devnet/svg/adobe-svg-viewer-download-area.html>

G. Interpret the Result

Click to browse sample [Result.htm](#) online

 Hong Kong Satellite Positioning Reference Station Network
 GNSS Automatic Computation Service

Applicant: Tai Man CHAN <ChanTai-man@hotmail.com>
 <TAI MAN CHAN/SMO/LANDSD/HKSARG>

Supports

- Multiple email addresses
- Lotus Notes email account for HKSARG users

Request: 2013-06-12 18:02:15 (HKT)
 Process: 2013-06-12 18:04:07 (HKT)

New Station Name: KL2

Computation Accuracy: 10mm + 3ppm

Upload files: 1. KL2_AM0-1.12o
 2. KL2_AM0-2.12o

916Kb KL2 1.547m
 833Kb KL2 1.547m

RINEX navigation file is not required

File size, station (marker) name and antenna height

Reference Station

No.	Station	Latitude (N)	Longitude (E)	Ell.Height
1	HKFN	22^ 29' 40.87008"	114^ 08' 17.40609"	41.210m
2	HKKT	22^ 26' 41.66174"	114^ 03' 59.63436"	34.557m
3	HKLT	22^ 25' 05.28272"	113^ 59' 47.84432"	125.935m

Chosen or the nearest 3 SatRef reference stations selected for computation

Observation Session

Sess	Start(HKT)	End(HKT)	Duration	Lapse
1	2012-05-03 11:41	2012-05-03 12:10	00:28(Pass)	
2	2012-05-03 12:40	2012-05-03 13:08	00:28(Pass)	00:30(Pass)

Screening of observation criteria:

- Duration : at least 15 minutes
- Lapse : at least 30 minutes at different times of day



SVG Chart to show Observation Sessions

Move mouse cursor to the bar to see the time details

- No data
- █ Tracked / Included
- █ Tracked / Excluded

Accuracy: 10mm+3ppm $\sigma = \sqrt{[10^2 + (3 \times 16.9)^2]} = 51.7$
Max $\sigma = 30$
Allowable = 2 $\sigma = 60mm$

Checking Origin - Misclosure Summary

Session	Origin	Length	Latitude	Longitude	Allowable	
1	HKFN - HKKT	9.2km	21.0mm	37.7mm	58.7mm	Pass
	HKFN - HKLT	16.9	6.9	9.6	60.0	Pass
	HKKT - HKLT	7.8	23.0	5.6	50.8	Pass
2	HKFN - HKKT	9.2km	33.0mm	16.3mm	58.7mm	Pass
	HKFN - HKLT	16.9	10.2	15.3	60.0	Pass
	HKKT - HKLT	7.8	20.7	14.9	50.8	Pass

Checking origin all pass

[Click to open baseline reports](#)

Baseline Ambiguity Status and Quality

No.	From	To	Sess	Dist	GDOP	3DQly	Fix	IonoAct	Frequency
1	HKFN	KL2	1	5.6	3.9	1.4	Yes	Auto	L1 + L2
2	HKKT	KL2	1	5.6	3.9	2.0	Yes	Auto	L1 + L2
3	HKLT	KL2	1	12.2	3.9	37.4	No	Medium	Iono Free (L3) ***
4	HKFN	KL2	2	5.6	4.0	1.5	Yes	Auto	L1 + L2
5	HKKT	KL2	2	5.6	4.0	3.1	Yes	Auto	L1 + L2
6	HKLT	KL2	2	12.2	4.0	2.5	Yes	Auto	L1 + L2

Integer ambiguity not fixed

Sess - Session No.
Dist - Slope distance in km
GDOP - Maximum GDOP
3DQly - 3D Quality
Fix - Integer Ambiguity Fixing
IonoAct - Ionospheric Activity settings (Auto, High, Medium)
Frequency - Automatic >15km : Iono Free (L3), else L1+L2

Repeated Baseline Checking – Discrepancy in Lat & Long < 2√2σ

Repeated Baseline Summary

Sess	GDOP	Delta Lat	Delta Long	Delta Ht	Remarks
HKFN - KL2					
1	3.9	-0'05.15344"	-3'15.38894"	-33.8539	Pass
2	4.0	-0'05.15419"	-3'15.38912"	-33.8629	
Spread:		22.5mm	5.4mm	2 Baselines	
Allowable:		55.2mm	55.2mm	L=5.587km	

Accuracy: 10mm+3ppm $\sigma = \sqrt{[10^2 + (3 \times 5.587)^2]} = 19.5$
Allowable = 2√2σ = 55.2mm

Sess	GDOP	Delta Lat	Delta Long	Delta Ht	Remarks
HKKT - KL2					
1	3.9	2'54.05372"	1'02.38135"	-27.2324	Pass
2	4.0	2'54.05292"	1'02.38181"	-27.2709	
Spread:		24.0mm	13.8mm	2 Baselines	
Allowable:		55.6mm	55.6mm	L=5.643km	

Sess	GDOP	Delta Lat	Delta Long	Delta Ht	Remarks
HKLT - KL2					
2	4.0	4'30.43509"	5'14.17032"	-118.3775	???

Only one baseline remains, no repeated checking

Least Squares Network Adjustment - Residuals Report (Trial 1) [Hide]

Click [Hide] [Show] to toggle display of trial's reports in html file

Allowable of Residual in Lat (E) & Long (N) = 2σ

Baseline	Session	Input (m)	Std Err (mm)	--Residual-- XYZ	ENH	Allowable ENH	
1 HKLT - KL2	2	DX	-6864.4883	16.2	-16.5	-52.1	60.0 Pass
		DY	-6661.1214	29.1	164.9	52.5	60.0 Pass
		DZ	7642.7248	17.2	121.7	191.9	
		DV	12243.4873				
2 HKKT - KL2	1	DX	-783.2845	16.2	32.3	-21.9	39.3 Pass
		DY	-2618.6880	29.1	-18.7	-20.0	39.3 Pass
		DZ	4937.0942	17.2	-34.1	-41.0	
		DV	5643.2225				
3 HKKT - KL2	2	DX	-783.2858	16.2	31.0	-8.7	39.3 Pass
		DY	-2618.7172	29.1	-47.9	-44.6	39.3 Fail ***
		DZ	4937.0567	17.2	-71.6	-79.4	
		DV	5643.2035				
4 HKFN - KL2	1	DX	5085.6751	16.2	-11.4	19.2	39.0 Pass
		DY	2308.2848	29.1	-21.6	16.5	39.0 Pass
		DZ	-159.4134	17.2	11.6	-9.5	
		DV	5587.2787				
5 HKFN - KL2	2	DX	5085.6796	16.2	-6.9	14.1	39.0 Pass
		DY	2308.2874	29.1	-19.0	-6.6	39.0 Pass
		DZ	-159.4382	17.2	-13.2	-18.5	
		DV	5587.2845				

*** indicates failure

Reject HKLT-KL2 Session No.2

Reject the largest residual baseline and put the remaining 4 baselines for re-adjustment

Least Squares Network Adjustment - Residuals Report (Final)

Baseline	Session	Input (m)	Std Err (mm)	--Residual-- XYZ	ENH	Allowable ENH	
1 HKLT - KL2	2	DX	-6864.4883	18.0	-14.8	-52.5	60.0 Pass
		DY	-6661.1214	32.9	162.3	48.5	60.0 Pass
		DZ	7642.7248	19.3	116.2	186.9	
		DV	12243.4873				
2 HKKT - KL2	1	DX	-783.2845	18.0	33.9	-22.3	39.3 Pass
		DY	-2618.6880	32.9	-21.3	-23.9	39.3 Pass
		DZ	4937.0942	19.3	-39.6	-45.9	
		DV	5643.2225				
3 HKFN - KL2	1	DX	5085.6751	18.0	-9.8	18.8	39.0 Pass
		DY	2308.2848	32.9	-24.2	12.5	39.0 Pass
		DZ	-159.4134	19.3	6.0	-14.4	
		DV	5587.2787				
4 HKFN - KL2	2	DX	5085.6796	18.0	-5.3	13.7	39.0 Pass
		DY	2308.2874	32.9	-21.7	-10.6	39.0 Pass
		DZ	-159.4382	19.3	-18.7	-23.4	
		DV	5587.2845				

```

* * * * *
*
* Final Result - KL2
*
* WGS84 (ITRF96) Geodetic Coordinates
* -----
* Latitude   = 22^ 29' 35.71624" N   Standard Error = 14.1mm
* Longitude  = 114^ 05' 02.01649" E   Standard Error = 13.3mm
* Ell Height = 7.3706m                 Standard Error = 37.5mm
*
* Hong Kong 1980 Grid Coordinates (By Two Step Transformation)
* -----
* Northing   = 839298.887m
* Easting    = 826700.138m
* Height     = 10.901m (for reference only)
*
*
* The station 'KL2' is
* - fixed by 4 independent GPS baselines
* - connected to 3 SatRef GPS stations
* - obtained from 2 observation sessions
*
*
* - computed by following baselines (sessions)
* ~ HKFN 12 (5.6km)
* ~ HKKT 1- (5.6km)
* ~ HKLT -2 (12.2km)
*
*
* Computation Accuracy : 10mm + 3ppm
* Maximum Standard Error : 30mm
* Minimum Session Duration : 15 minutes
* Minimum Session Lapse : 30 minutes
* Elevation Mask : 15 degrees
* Reject GDOP Exceed : 5
* Frequency Strategy : Auto Preference
*
*
* This automatic computation result is for reference purpose
* only. Different survey purposes have different survey
* specifications and requirements. Lands Department gives no
* guarantee regarding the correctness and completeness of this
* automatic computation and shall not be liable for any loss
* and damages arising from or related to the use of this
* automatic computation result. Please verify this automatic
* computation result before use.
*
*
* 1.22.000725 * 2013-06-12 18:10:20 (HKT) *

```

Adjusted HK1980 Coordinates

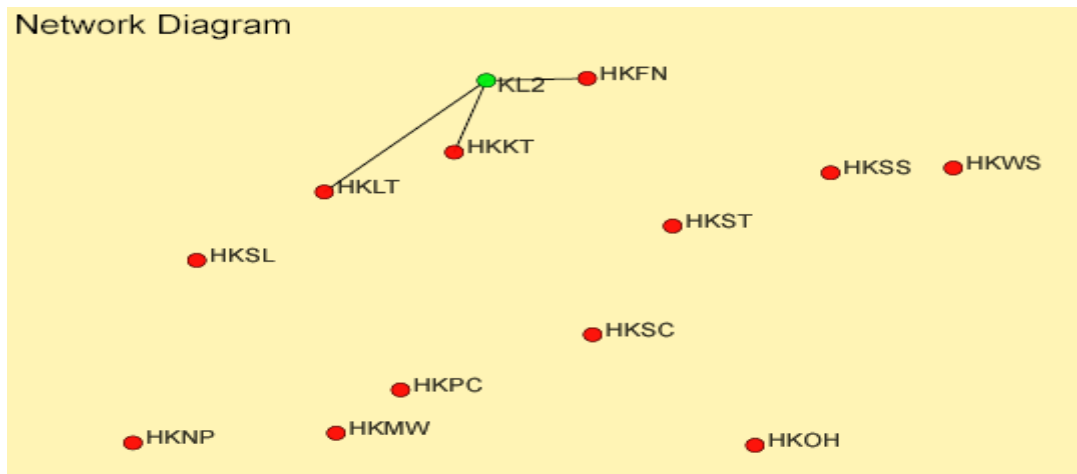
Achievement

Requirements
(at least 3)
(at least 2)
(at least 2)

Sessions used in final adjustment

Settings

See Tips (T.5)

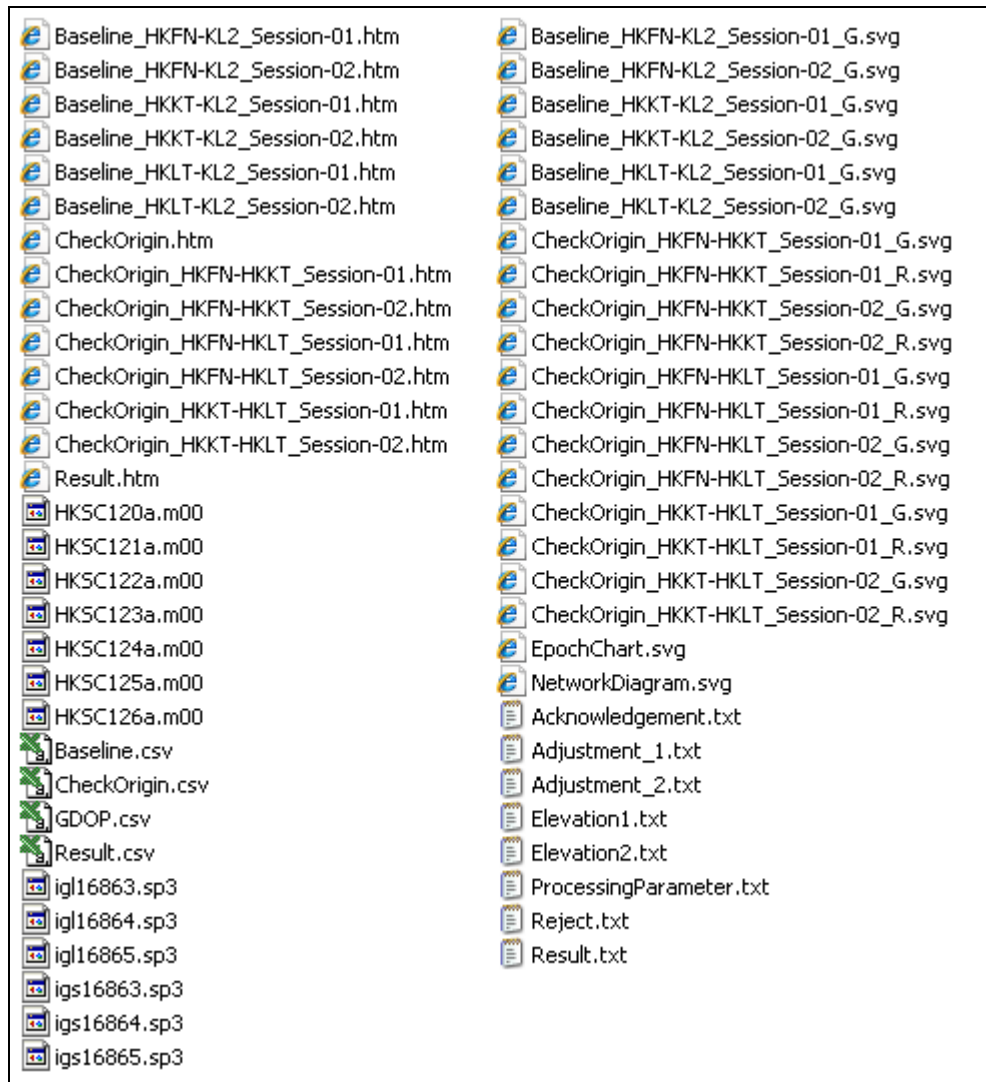


Remarks: Please click below links to get HTML result and full report.
The link is valid until 2013-08-12.

[Result.htm](#) [FullReport.zip](#) **Download result and full report via these links**

H. Download FullReport.zip

Click to download sample [FullReport.zip](#)



I. General Processing Parameter – ProcessingParameter.txt

This GNSS computation project was processed by LEICA Geo Office 8.3

Typical Processing Parameters

Cut-off angle : 15^
Ephemeris type (GPS) : Precise
Ephemeris type (GLONASS) : Broadcast
Solution type : Phase Fixed: All Fix
GNSS type : GPS
Frequency : L1 + L2
Fix ambiguities up to : 80km
Min. time for float solution : 05'00"
Sampling rate : 5 Sec
Tropospheric model : Hopfield
Ionospheric model : Computed
Use stochastic modelling : Yes
Min. dist. stochastic model : 1km
Ionospheric activity : Automatic

Rover Station Information

Receiver Type : SR530
Receiver S/N : 31291
Antenna Type : LEIAT502
Antenna Height : 1.54700
Horizontal Offset : +0.0000m
Vertical offset : +0.0000m
Phase Center Offsets :
 Vertical (L1,L2) : +0.0618m, +0.0654m
 East (L1,L2) : +0.0020m, +0.0018m
 North (L1,L2) : +0.0003m, -0.0014m

Computation Accuracy Standard and Checking Criteria

Computation Standard = 10mm + 3ppm

Accuracy Standard (S in mm) = $[10^2 + (3*L)^2]^{0.5}$
Maximum S = 30mm (whichever the less)
where L = length of baseline in km

Allowable of Checking Control Origin:

Abs[dLat(obs) - dLat(comp)] < 2*S
Abs[dLon(obs) - dLon(comp)] < 2*S

Allowable Discrepancy of Repeated Baseline:

Spread of dLat < $2*2^{0.5}*S$
Spread of dLon < $2*2^{0.5}*S$
Spread of dHt < $2*2^{0.5}*S*3$ See Note 1

Allowable Residuals of Least Squares Network Adjustment:

Abs[dLat(obs) - dLat(comp)] < 2*S
Abs[dLon(obs) - dLon(comp)] < 2*S
Abs[dHt(obs) - dHt(comp)] < $2*S*3$ See Note 1

Observation Session:

Minimum 2 sessions
Minimum 15 minutes per session
Time Lapse >= 30 minutes on the same or different day
GDOP <= 5

Reference Station Connection:

At least 3 independent GPS baselines
At least 2 reference stations

Note 1: The checking of vertical component is for geodetic survey only.

User Selected Options

Computation Accuracy = 10mm + 3ppm
Maximum Standard Error = 30mm
Land Boundary Survey Standard = True
Check Origin = True
Reference Station = HKFN,HKKT,HKLT
Minimum No. of Reference Station = 2
Minimum No. of Session = 2
Minimum Session Duration = 15 minutes
Minimum Interval = 30 minutes
Minimum No. of Baseline = 3
Elevation Mask = 15
Maximum GDOP = 5
Reject Large GDOP = True
Epoch Rate = 5 seconds
Divide Observation file for every = N.A.

Two Step Transformation: 2_Step_(21_2_2005)

Ellipsoid A: WGS 1984

- Semi Major Axis: 6378137.00000
- Flattening 1/f : 298.25722356300

Ellipsoid B: International (Hayford)

- Semi Major Axis: 6378388.00000
- Flattening 1/f : 297.00000000000

Projection : HK1980

Step One: Pre-Transformation - 7P

- Shift dx : 162.61900
- Shift dy : 276.96100
- Shift dz : 161.76300
- Rotate Rx : 0.067741"
- Rotate Ry : -2.243649"
- Rotate Rz : -1.158827"
- Scale Factor: 1.094239

Step Two:

- Shift dx : -0.00015
- Shift dy : -0.00002
- Rotate Rz : 0.000002"
- Scale Factor: 0.00733723

J. Checking Origin Detail Report – CheckOrigin.htm

Checking Origin - Session 1 (2012-05-03 11:26 to 12:25 HKT)								
		Latitude			Longitude			Remark
		deg	min	sec	deg	min	sec	
Station Name	HKFN	22	29	40.87008	114	08	17.40609	(1)
	HKKT	22	26	41.66174	114	03	59.63436	(2)
Computed Baseline Component		-0	02	59.20834	-0	04	17.77173	(3) = (2) - (1)
Measured Baseline Component		-0	02	59.20764	-0	04	17.77047	(4)
Difference (0.0001" = 3mm)		21.0mm			37.7mm			(5) = (3) - (4)
Allowable Difference = 2σ $\sigma = \sqrt{\{ 10^2 + (3*9.2)^2 \}}$		58.7mm			58.7mm			Pass

		Latitude			Longitude			Remark
		deg	min	sec	deg	min	sec	
Station Name	HKFN	22	29	40.87008	114	08	17.40609	(1)
	HKLT	22	25	05.28272	113	59	47.84432	(2)
Computed Baseline Component		-0	04	35.58736	-0	08	29.56177	(3) = (2) - (1)
Measured Baseline Component		-0	04	35.58759	-0	08	29.56209	(4)
Difference (0.0001" = 3mm)		6.9mm			9.6mm			(5) = (3) - (4)
Allowable Difference = 2σ $\sigma = \sqrt{\{ 10^2 + (3*16.9)^2 \}}$		60.0mm			60.0mm			Pass

		Latitude			Longitude			Remark
		deg	min	sec	deg	min	sec	
Station Name	HKKT	-0	01	36.37902	-0	04	11.79004	(1)
	HKLT	-0	01	36.37825	-0	04	11.78985	(2)
Computed Baseline Component		-0	01	36.37902	-0	04	11.79004	(3) = (2) - (1)
Measured Baseline Component		-0	01	36.37825	-0	04	11.78985	(4)
Difference (0.0001" = 3mm)		23.0mm			5.6mm			(5) = (3) - (4)
Allowable Difference = 2σ $\sigma = \sqrt{\{ 10^2 + (3*7.8)^2 \}}$		50.8mm			50.8mm			Pass

Accuracy Requirement: 10mm+3ppm
Standard Error of HKFN – HKLT
 $\sigma = \sqrt{[10^2 + (3 \times 16.9)^2]}$ mm = 51.7mm
 (max = 30mm)
Allowable = $2\sigma = 60.0$ mm

K. Rejection of Large GDOP Observations by Windowing – GDOP.csv

GDOP						
A	B	C	D	E	F	G
Session	Start	End	MaxGDOP	MaxHDOP	MaxVDOP	Remark
1	2011-06-09 3:29:25	2011-06-09 3:59:54	5.344	1.607	4.057	Whole Session
1	2011-06-09 3:29:25	2011-06-09 3:29:58	3.682	1.4	2.686	
1	2011-06-09 3:30:00	2011-06-09 3:30:59	3.668	1.4	2.675	
1	2011-06-09 3:30:59	2011-06-09 3:31:58	3.641	1.399	2.653	
<p>The rover (unknown station) observations were computed by SPP (Single Point Positioning) to acquire maximum GDOP information.</p> <p>If the maximum GDOP in the whole session exceeds the threshold value, individual small interval will be checked again to identify poor GDOP observations time for rejection (windowing).</p>			3.614	1.399	2.632	
			3.588	1.399	2.61	
			3.561	1.399	2.589	
			3.535	1.4	2.568	
			3.51	1.401	2.547	
			3.485	1.402	2.527	
			3.46	1.403	2.506	
1	2011-06-09 3:40:00	2011-06-09 3:40:59	3.411	1.406	2.466	
1	2011-06-09 3:40:59	2011-06-09 3:41:58	3.387	1.408	2.446	
1	2011-06-09 3:42:00	2011-06-09 3:42:59	3.364	1.41	2.426	
1	2011-06-09 3:43:00	2011-06-09 3:43:59	3.34	1.413	2.406	
1	2011-06-09 3:43:59	2011-06-09 3:44:58	3.318	1.415	2.387	
1	2011-06-09 3:45:00	2011-06-09 3:45:58	3.295	1.418	2.368	
1	2011-06-09 3:46:00	2011-06-09 3:46:59	3.273	1.42	2.349	
1	2011-06-09 3:46:59	2011-06-09 3:47:58	3.251	1.423	2.33	
1	2011-06-09 3:47:59	2011-06-09 3:48:58	3.23	1.426	2.311	
1	2011-06-09 3:49:00	2011-06-09 3:49:59	3.209	1.429	2.292	
1	2011-06-09 3:49:59	2011-06-09 3:50:59	3.188	1.433	2.274	
1	2011-06-09 3:50:59	2011-06-09 3:51:58	3.167	1.436	2.255	
1	2011-06-09 3:52:00	2011-06-09 3:52:59	5.35	1.575	4.062	Reject GDOP>5.0
1	2011-06-09 3:53:00	2011-06-09 3:53:59	5.339	1.58	4.054	Reject GDOP>5.0
1	2011-06-09 3:53:59	2011-06-09 3:54:58	5.319	1.585	4.039	Reject GDOP>5.0
1	2011-06-09 3:55:00	2011-06-09 3:55:59	5.298	1.59	4.024	Reject GDOP>5.0
1	2011-06-09 3:56:00	2011-06-09 3:56:59	5.275	1.595	4.007	Reject GDOP>5.0
1	2011-06-09 3:56:59	2011-06-09 3:57:58	5.252	1.601	3.99	Reject GDOP>5.0
1	2011-06-09 3:58:00	2011-06-09 3:58:58	5.227	1.606	3.971	Reject GDOP>5.0
1	2011-06-09 3:59:00	2011-06-09 3:59:54	5.201	1.607	3.952	Reject GDOP>5.0
2	2011-06-09 4:30:00	2011-06-09 5:00:30	3.136	1.151	2.496	Whole Session

Point Id	Point Class	Start	Duration	11:30	12:00	12:30	13:00
HKMW	Control	06/09/2011 11:14:10	1h 00' 25"	[Red bar]			
HKNP	Control	06/09/2011 11:14:10	1h 00' 25"	[Red bar]			
HKPC	Control	06/09/2011 11:14:10	1h 00' 25"	[Red bar]			
USM1	Averaged	06/09/2011 11:29:10	30' 30"	[Green bar]			

Edit Window (Include) [?] [X]

Point Id: Satellite:

Interval

Start: Window Start:

End: Window End:

Duration: Window Duration:

L. Satellite Elevation and Epoch by TEQC – Elevation1.txt

Satellite Elevation and Epoch by TEQC

Session	No.	SV	No. of Epoch	Elevation	>=15
1. 2012-05-03 11:41	1	G15	184	7.8	No
	2	G09	966	13.1	No
1. 2012-05-03 11:41	1	G21	1593	18.5	Yes
	2	G31	1713	33.9	Yes
	3	G12	1713	34.7	Yes
	4	G14	1713	39.1	Yes
	5	G25	1713	52.4	Yes
	6	G18	1713	64.9	Yes
	7	G22	1713	66.6	Yes
2. 2012-05-03 12:40	1	G29	256	8.5	No
	1	G30	1627	18.2	Yes
2. 2012-05-03 12:40	2	G12	1686	19.3	Yes
	3	G18	1686	38.2	Yes
	4	G31	1686	47.4	Yes
	5	G14	1686	48.9	Yes
	6	G25	1686	57.5	Yes
	7	G22	1686	78.5	Yes

M. Check Elevation Mask and Satellite by LGO SPP – Elevation2.txt

Check Elevation Mask and Satellite by LGO SPP

Sess >=	GDOP	GPS	GLO	L1Obs	Satellite List	
1	0	2.7	9	0	2600 G9,G12,G14,G15,G18,G21,G22,G25,G31	
	5	2.7	9	0	2600 G9,G12,G14,G15,G18,G21,G22,G25,G31	
	6	2.7	9	0	2600 G9,G12,G14,G15,G18,G21,G22,G25,G31	
	7	2.7	9	0	2600 G9,G12,G14,G15,G18,G21,G22,G25,G31	
	8	2.7	9	0	2600 G9,G12,G14,G15,G18,G21,G22,G25,G31	
	9	2.7	9	0	2600 G9,G12,G14,G15,G18,G21,G22,G25,G31	
	10	2.7	9	0	2597 G9,G12,G14,G15,G18,G21,G22,G25,G31	
	11	2.7	8	0	2564 G9,G12,G14, G18,G21,G22,G25,G31	
	12	2.7	8	0	2564 G9,G12,G14, G18,G21,G22,G25,G31	
	13	3.7	8	0	2542 G9,G12,G14, G18,G21,G22,G25,G31	
	14	3.9	8	0	2492 G9,G12,G14, G18,G21,G22,G25,G31	
	15	3.9	8	0	2424 G9,G12,G14, G18,G21,G22,G25,G31	
	2	0	2.3	8	0	2394 G12,G14,G18,G22,G25,G29,G30,G31
		5	2.3	8	0	2394 G12,G14,G18,G22,G25,G29,G30,G31
		6	2.3	8	0	2394 G12,G14,G18,G22,G25,G29,G30,G31
7		2.3	8	0	2394 G12,G14,G18,G22,G25,G29,G30,G31	
8		2.3	8	0	2394 G12,G14,G18,G22,G25,G29,G30,G31	
9		2.3	8	0	2394 G12,G14,G18,G22,G25,G29,G30,G31	
10		2.3	8	0	2394 G12,G14,G18,G22,G25,G29,G30,G31	
11		2.3	8	0	2351 G12,G14,G18,G22,G25,G29,G30,G31	
12		2.3	7	0	2345 G12,G14,G18,G22,G25, G30,G31	
13		3.6	7	0	2325 G12,G14,G18,G22,G25, G30,G31	
14		3.6	7	0	2296 G12,G14,G18,G22,G25, G30,G31	
15		4.0	7	0	2249 G12,G14,G18,G22,G25, G30,G31	

N. Baseline Detail Report

e.g. Baseline_HKFN-KL2_Session-01.htm

```
*****
* Baseline HKFN - KL2 Session 1 *
*****
```

Project Information

```
-----
Project Name:          LBS2
Date Created:         2013-06-12 18:08:24 (HKT)
Coordinate System Name: 2_Step_(21_2_2005)
Application Software:  LEICA Geo Office 8.3
Processing Kernel:    PSI-Pro 3.0
```

Processing Parameters

```
-----
Parameters                Selected                Used
Cut-off angle:            15^                15^
Ephemeris type (GPS):    Precise            Precise
Ephemeris type (GLONASS): Precise            Broadcast
Solution type:          Phase Fixed: All Fix Phase Fixed: All Fix
GNSS type:              Automatic          GPS
Frequency:              Automatic          L1 + L2
Fix ambiguities up to:  80km              80km
Min. duration for float solution: 05'00"          05'00"
Sampling rate:          5 Sec            5 Sec
Tropospheric model:     Hopfield          Hopfield
Ionospheric model:      Automatic        Computed
Use stochastic modelling: Yes                Yes
Min. dist. stochastic modelling: 1km              1km
Ionospheric activity:   Automatic        Automatic
```

Station Information

```
-----
Station:                Reference: HKFN          Rover: KL2
Receiver type:          GRX1200+              SR530
Receiver s/n:          455689                31291
Antenna type:          LEIAR25.R4          LEIT          LEIAT502
Antenna Height:        1.7780m              1.5470m
Horizontal offset:     +0.0000m              +0.0000m
Vertical offset:       +0.0000m              +0.0000m
Phase center offsets:
  Vertical (L1,L2):    +0.1732m, +0.1636m    +0.0618m, +0.0654m
  East (L1,L2):       -0.0004m, -0.0001m    +0.0020m, +0.0018m
  North (L1,L2):      +0.0008m, -0.0006m    +0.0003m, -0.0014m
Initial coordinates:
  Latitude:           22^ 29' 40.87008" N    22^ 29' 35.85557" N
  Longitude:          114^ 08' 17.40609" E    114^ 05' 01.99336" E
  Ellip. Height:      41.2100 m              7.8103 m

Start Time (UTC):      2012-05-03 03:42:00
End Time:              2012-05-03 04:10:25
Duration:              00:28:25
```

Observation Statistics

```

-----
Number of common epochs:          342
Number of L1 observations used:    2420
Number of L1 observations rejected: 6
Number of L2 observations used:    2363
Number of L2 observations rejected: 1
  
```

Tracking Details: L1

```

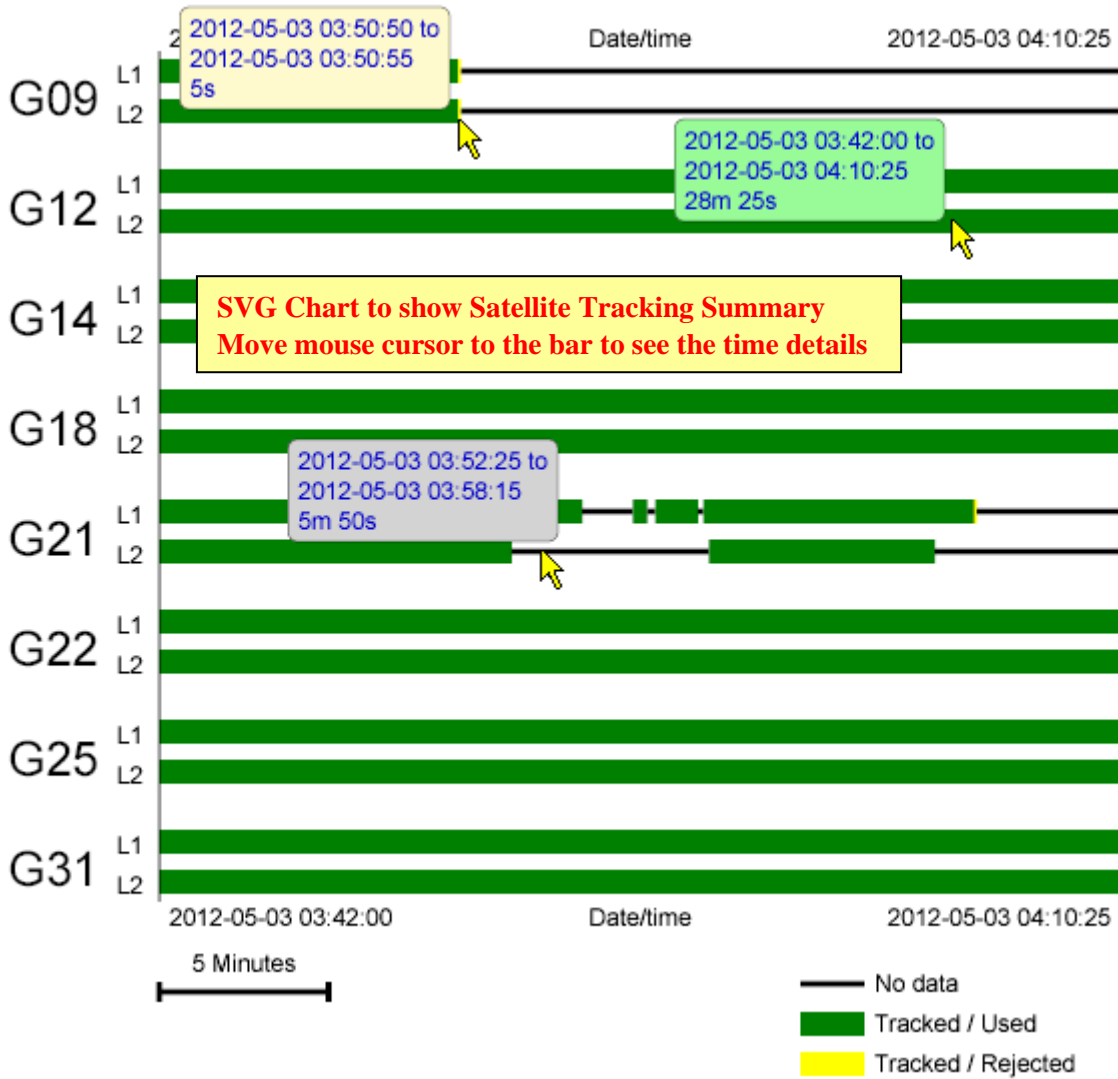
-----
Sv      From (UTC)                To                Span              Status
-----
G09     2012-05-03 03:42:00 2012-05-03 03:50:50 00:08:50 Used
        2012-05-03 03:50:50 2012-05-03 03:50:55 00:00:05 Rejected
        2012-05-03 03:50:55 2012-05-03 04:10:25 00:19:30 No data
G12     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
G14     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
G18     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
G21     2012-05-03 03:42:00 2012-05-03 03:54:30 00:12:30 Used
        2012-05-03 03:54:30 2012-05-03 03:56:00 00:01:30 No data
        2012-05-03 03:56:00 2012-05-03 03:56:25 00:00:25 Used
        2012-05-03 03:56:25 2012-05-03 03:56:40 00:00:15 No data
        2012-05-03 03:56:40 2012-05-03 03:57:55 00:01:15 Used
        2012-05-03 03:57:55 2012-05-03 03:58:05 00:00:10 No data
        2012-05-03 03:58:05 2012-05-03 04:06:05 00:08:00 Used
        2012-05-03 04:06:05 2012-05-03 04:06:10 00:00:05 Rejected
        2012-05-03 04:06:10 2012-05-03 04:10:25 00:04:15 No data
G22     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
G25     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
G31     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
  
```

Tracking Details: L2

```

-----
Sv      From (UTC)                To                Span              Status
-----
G09     2012-05-03 03:42:00 2012-05-03 03:50:50 00:08:50 Used
        2012-05-03 03:50:50 2012-05-03 03:50:55 00:00:05 Rejected
        2012-05-03 03:50:55 2012-05-03 04:10:25 00:19:30 No data
G12     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
G14     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
G18     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
G21     2012-05-03 03:42:00 2012-05-03 03:52:25 00:10:25 Used
        2012-05-03 03:52:25 2012-05-03 03:58:15 00:05:50 No data
        2012-05-03 03:58:15 2012-05-03 04:04:55 00:06:40 Used
        2012-05-03 04:04:55 2012-05-03 04:10:25 00:05:30 No data
G22     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
G25     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
G31     2012-05-03 03:42:00 2012-05-03 04:10:25 00:28:25 Used
  
```

Tracking Summary



GDOP: 2.100 - 3.900
 PDOP: 1.800 - 3.200
 HDOP: 0.900 - 1.300
 VDOP: 1.500 - 2.900

User Selected Options

Computation Accuracy = 10mm + 3ppm
 Maximum Standard Error = 30mm
 Land Boundary Survey Standard = True
 Check Origin = True
 Reference Station = HKFN, HKKT, HKLT
 Minimum No. of Reference Station = 2
 Minimum No. of Session = 2
 Minimum Session Duration = 15 minutes
 Minimum Interval = 30 minutes
 Minimum No. of Baseline = 3
 Elevation Mask = 15
 Maximum GDOP = 5
 Reject Large GDOP = True
 Epoch Rate = 5 seconds
 Divide Observation file for every = N.A.

P. SatRef 10-min Raw Data File

Name	Type	Size	Date Modified
Result.htm	HTML Document	27 KB	2012-06-28 08:00
HKSC120a.m00	M00 File	353 KB	2012-04-29 08:13
HKSC121a.m00	M00 File	353 KB	2012-04-30 08:13
HKSC122a.m00	M00 File	353 KB	2012-05-01 08:13
HKSC123a.m00	M00 File	352 KB	2012-05-02 08:13
HKSC124a.m00	M00 File	352 KB	2012-05-03 08:13
HKSC125a.m00	M00 File	347 KB	2012-05-04 08:13
HKSC126a.m00	M00 File	338 KB	2012-05-05 08:13
Baseline.csv	Microsoft Excel Comma Separated Values File	4 KB	2012-06-28 08:00
CheckOrigin.csv	Microsoft Excel Comma Separated Values File	5 KB	2012-06-28 07:59
GDOP.csv	Microsoft Excel Comma Separated Values File	1 KB	2012-06-28 07:59
Result.csv	Microsoft Excel Comma Separated Values File	1 KB	2012-06-28 08:00
igl16863.sp3	SP3 File	187 KB	2012-06-28 07:58
igl16864.sp3	SP3 File	187 KB	2012-06-28 07:58
igl16865.sp3	SP3 File	187 KB	2012-06-28 07:58
igs16863.sp3	SP3 File	246 KB	2012-06-28 07:58

SatRef 10-min Leica's raw data files are used for providing almanacs information in the LGO computation.

Q. IGS Precise Orbits SP3 File

Name	Type	Size	Date Modified
Baseline.csv	Microsoft Excel Comma Separated Values File	4 KB	2012-06-28 08:00
CheckOrigin.csv	Microsoft Excel Comma Separated Values File	5 KB	2012-06-28 07:59
GDOP.csv	Microsoft Excel Comma Separated Values File	1 KB	2012-06-28 07:59
Result.csv	Microsoft Excel Comma Separated Values File	1 KB	2012-06-28 08:00
igl16863.sp3	SP3 File	187 KB	2012-06-28 07:58
igl16864.sp3	SP3 File	187 KB	2012-06-28 07:58
igl16865.sp3	SP3 File	187 KB	2012-06-28 07:58
igs16863.sp3	SP3 File	246 KB	2012-06-28 07:58
igs16864.sp3	SP3 File	246 KB	2012-06-28 07:57
igs16865.sp3	SP3 File	245 KB	2012-06-28 07:58
Baseline_HKFN-KL2_5...	SVG Document	14 KB	2012-06-28 08:00

GLONASS Precise Satellite Orbits

GPS Precise Satellite Final Orbits

By default, SatRef collects International GNSS Service (IGS) precise satellite (final) orbits products of the day, one previous day and one next day of the rover observation period for LGO computation.

http://igsb.jpl.nasa.gov/components/dcnav/igsb_product_www.html

http://igsb.jpl.nasa.gov/components/dcnav/cddis_glo.htm

R.1 Common Problem – Insufficient Reference Station

```


=====
Hong Kong Satellite Positioning Reference Station Network
GPS Automatic Computation Service
=====
Applica:
Request Process
New Sta
Computation Accuracy: 10mm + 3ppm

Upload files: 1. hkst034e10.11o      89K
               2. hkst035c20.11o      80K

Reference Station
-----
No.  Station      Latitude (N)      Longitude (E)      Ell.Height
-----
1    HKSC         22^ 19' 19.81950"  114^ 08' 28.27647"  20.227m
-----

```

Message from webpage [X]

 Please input at least 2 stations as reference.

OK

```

*****
* Computation Terminated - Selected no. of reference station less than 2 *
*****

```

Step 2: Select the Reference Station (if necessary):

Select Reference Station sites manually (if no selection, the nearest 3 reference stations will be used)

- HKSS - Shap Sze Heung
- HKWS - Wong Shek
- HKOH - Obelisk Hill

Un-tick the checkbox to choose the nearest 3 reference station automatically

Step 2: Select the Reference Station (if necessary):

Select Reference Station sites manually (if no selection, the nearest 3 reference stations will be used)

- HKSS - Shap Sze Heung
- HKWS - Wong Shek
- HKOH - Obelisk Hill
- HKPC - Peng Chau
- HKNP - Ngong Ping
- HKMW - Mui Wo

Choose any number of reference station manually

R.2 Common Problem – Only One Observation RINEX File Uploaded

```
New Station Name: Unknown

Computation Accuracy: 10mm + 3ppm

Upload file: 1. hkst034e10.11o      89K      Only one observation
                                             RINEX file uploaded

Reference Station
-----
No.  Station      Latitude (N)      Longitude (E)      Ell.Height
-----
1    HKFN         22^ 29' 40.87008" 114^ 08' 17.40609" 41.210m
2    HKKT         22^ 26' 41.66174" 114^ 03' 59.63436" 34.557m
3    HKLT         22^ 25' 05.28272" 113^ 59' 47.84432" 125.935m
-----

Observation Session      Duration less than 15 minutes
-----
Sess  Start (HKT)      End(HKT)      Duration      Lapse
-----
1     2011-02-03 12:09 2011-02-03 12:19 00:10 (Fail)      ***
-----

*****
* Computation Terminated - Valid no. of observation session less than 2 *
*****
```

R.3 Common Problem – One Long Observation RINEX File Uploaded

SatRef GPS Automatic Computation Service - Acknowledgement

□ SatRef-CA1
To chantai-man@hotmail.com

The following file is received on 2012-05-27 17:23:00

1. KL2_AM0.12o 2633 Kb **Only one session is uploaded**

Selected Options:
Reference Station = Nearest 3
Computation Accuracy = 10mm+3ppm
Minimum No. of Reference Station = 2
Minimum No. of Session = 2
Minimum Duration = 15 min. **Session criterion**
Minimum Interval = 30 min.
Minimum No. of Baseline = 3
Maximum GDOP = 5.0
Epoch Rate = 5 sec.
Divide Observation file for every = N.A.
Land Boundary Survey Standard = True
Check Origin = True
Reject Large GDOP = True
Elevation Mask = 15 deg.

If the duration of the only one uploaded session is long enough, AutoComp will automatically divide the uploaded file into 2 session files with required time lapse.

Upload file: 1. KL2_AM0.12o 2633Kb

Your obs file 'KL2_AM0.12o' was divided into 2 session-files

Observation Session

Sess	Start (HKT)	End (HKT)	Duration	Lapse
1	2012-05-03 11:41	2012-05-03 12:10	00:28 (Pass)	
2	2012-05-03 12:40	2012-05-03 13:08	00:28 (Pass)	00:30 (Pass)

R.4 Common Problem – Insufficient Observation Duration

```
Upload files: 1. hkst012a20-a35.11o 108K
              2. hkst035b.11o      396K
```

Two observation files uploaded

Reference Station

No.	Station	Latitude (N)	Longitude (E)	Ell.Height
1	HKSC	22^ 19' 19.81950"	114^ 08' 28.27647"	20.227m
2	HKSS	22^ 25' 51.84451"	114^ 16' 09.45642"	38.709m
3	HKFN	22^ 29' 40.87008"	114^ 08' 17.40609"	41.210m

The first file is less than 15 minutes duration

Observation Session

Sess	Start (HKT)	End (HKT)	Duration	Lapse
1	2011-01-12 08:20	2011-01-12 08:33	00:14 (Fail)	***
2	2011-02-04 09:09	2011-02-04 09:59	00:50 (Pass)	00:36 (Pass)

```
*****
* Computation Terminated - Valid no. of observation session less than 2 *
*****
```

R.5 Common Problem – Insufficient Time Lapse

Upload files: 1. hkst012a20-a35.11o 116K
 2. hkst012a35-a50.11o 133K
 3. hkst035b.11o 482K

Three observation RINEX files uploaded

Reference Station

No.	Station	Latitude (N)	Longitude (E)	Ell.Height
1	HKFN	22^ 29' 40.87008"	114^ 08' 17.40609"	41.210m
2	HKKT	22^ 26' 41.66174"	114^ 03' 59.63436"	34.557m
3	HKLT	22^ 25' 05.28272"	113^ 59' 47.84432"	125.935m

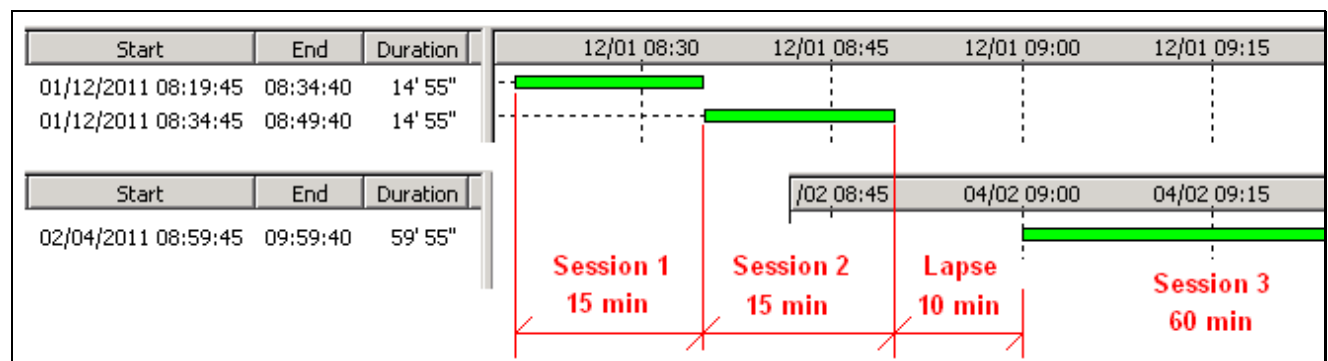
All sessions duration >= 15min

Lapse between 1-2 and 2-3 are both less than 30 minutes

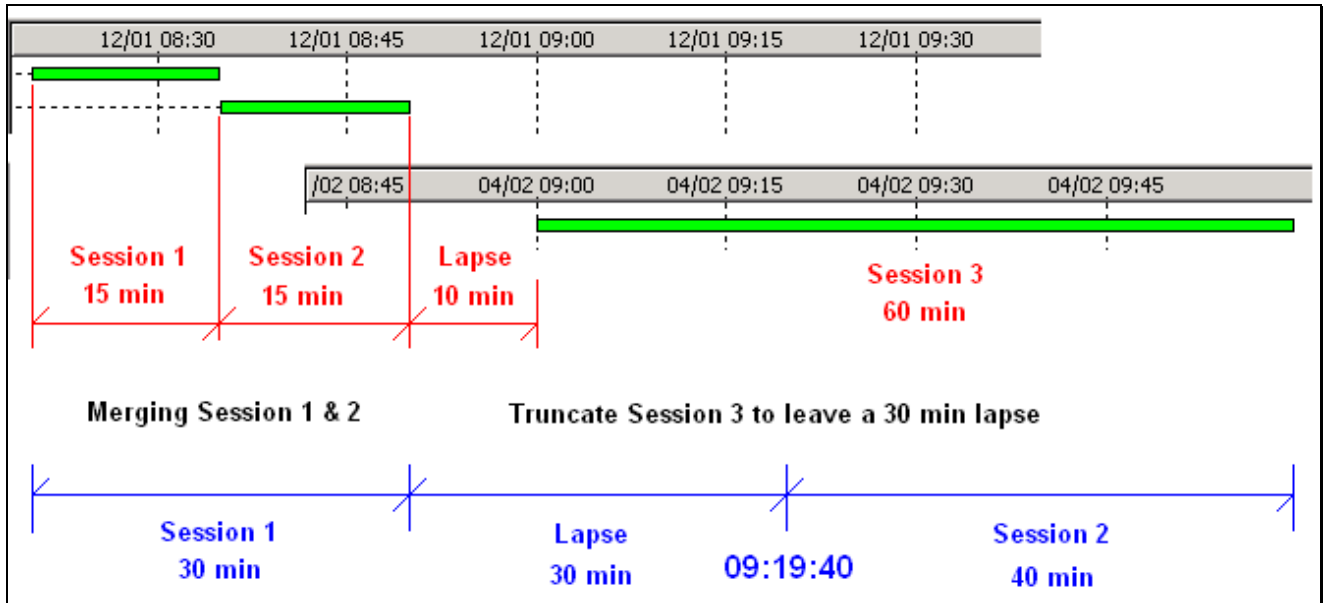
Observation Session

Sess	Start (HKT)	End (HKT)	Duration	Lapse
1	2011-01-12 08:20	2011-01-12 08:34	00:15 (Pass)	
2	2011-01-12 08:34	2011-01-12 08:49	00:15 (Pass)	00:00 (Fail) ***
3	2011-02-04 08:59	2011-02-04 09:59	01:00 (Pass)	00:10 (Fail) ***

 * Computation Terminated - Valid no. of observation session less than 2 *



Rearrange the observation RINEX files



Append all observation data of session 2 to session 1

The screenshot shows two Notepad windows. The top window, 'Session_1.11o - Notepad', contains RINEX observation data for Session 1. The bottom window, 'Session_2.11o - Notepad', contains RINEX observation data for Session 2. A red arrow points from the data in Session 2 to the end of Session 1, indicating that the data from Session 2 is being appended to Session 1.

Session 1 Data (Top Window):

```

24391126.340 128176206.13606 24391127.220 99877552.90045
22390979.420 117655282.87000 22390979.420 81687312.70345
23323344.740 122.
21920275.380 115.
21518061.680 113.
23600464.640 124.
20377091.340 107.
23535404.980 123.
11 01 12 00 34 50.0
22246226.080 116.
24394143.500 128.
22393782.800 117.
23326069.040 122.
21919296.920 115.
21518393.300 113.
23603473.180 124.
20376180.800 107.
23537137.040 123.
11 01 12 00 34 55.0
22244066.420 116.
24397159.800 128.
22396587.100 117.
23328793.100 122.
21918318.320 115.
21518727.720 113.
23606481.580 124.
20375272.560 107.
23538871.340 123.
    
```

Session 2 Data (Bottom Window):

```

2.11 OBSERVATION DATA G RINEX V
SPIDER V4,0,0,3554 2011 01 12 00:31 PGM / R
HKST MARKER
HKST MARKER
SMO Lands Department HKSAR OBSERVE
455690 LEICA GRX1200PRO 8.01/2.125 REC # /
LEIAT504 LEIS ANT # /
-2417142.8791 5382345.4978 2415036.9430 APPROX
0.0083 0.0000 0.0000 ANTENNA
1 1 WAVELEN
4 C1 L1 P2 L2 # / TYP
5.000 INTERVA
2011 01 12 00 35 0.0000000 GPS TIME OF
15 LEAP SE
END OF
11 01 12 00 35 0.000000 0 9604G07G08G11G17G20G24G28G32
22241908.720 116882015.51308 22241909.240 91076895.67247
24400175.540 128223759.94506 24400176.440 99914607.78545
22399392.580 117709593.52008 22399392.920 91721764.17246
23331517.220 122607934.26507 23331517.040 95538632.64345
21917339.840 115176400.86608 21917339.200 89747845.82248
21519065.220 113083439.41509 21519065.320 88116969.40848
23540608.220 123706711.56507 23540609.900 96394825.51545
11 01 12 00 35 5.000000 0 9604G07G08G11G17G20G24G28G32
22239753.800 116870691.44708 22239754.360 91068071.72247
    
```

Append all observation data of session 2 to session 1

Locate the starting time of the new session 2 from session 3 file

Session_3.11o - Notepad

File Edit Format View Help

```

2.11 OBSERVATION DATA G RINEX VERSION / TYPE
SPIDER V4,0,0,3554 2011 02 04 02:03 PGM / RUN BY / DATE
HKST MARKER NAME
HKST MARKER NUMBER
SMO Lands Department HKSAR OBSERVER / AGENCY
455690 LEICA GRX1200PRO 8.01/2.125 REC # / TYPE / VERSION
LEIAT504 LEIS ANT # / TYPE
-2417142.8791 5382345.4978 2415036.9430 APPROX POSITION XY
0.0083 0.0000 0.0000 ANTENNA: DELTA H/E
1 1 WAVELENGTH FACT L1/L2
4 C1 L1 P2 L2 # / TYPES OF OBSERVATION
5.000 INTERVAL
2011 02 04 01 00 0.0000000 GPS TIME OF FIRST OBSERVATION
2011 02 04 01 59 55.0000000 GPS TIME OF LAST OBSERVATION
15 LEAP SECONDS
END OF HEADER
11 02 04 01 00 0.0000000 0 10G02G04G05G10G12G13G17G20G23G28
22677603.000 119171577.35508 22677603.180 92860954.16947
20953916.400 775.37048
24184375.520 982.96745
20671340.800 657.18248
24637691.900 223.69645
23752533.920 677.77044
20853324.420 856.50149
24464585.400 334.57143
24387921.020 440.74844
21899647.120 115083391.06608 21899647.660 89675359.13446
11 02 04 01 00 5.0000000 0 10G02G04G05G10G12G13G17G20G23G28
22676421.840 119165370.20408 22676422.000 92856117.43747
20954110.900 110114581.58509 20954112.140 85803571.86848
24180993.640 127071975.53907 24180996.520 99017134.75645

```

Find

Find what: 11 02 04 01 20

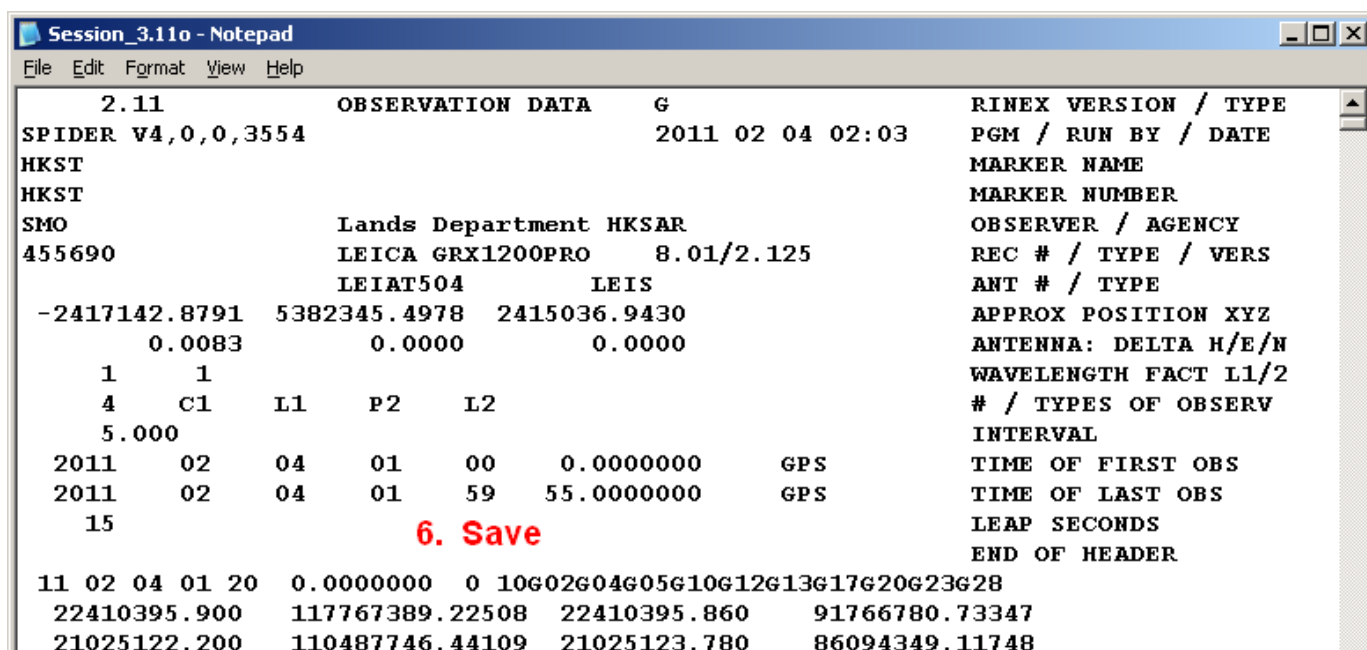
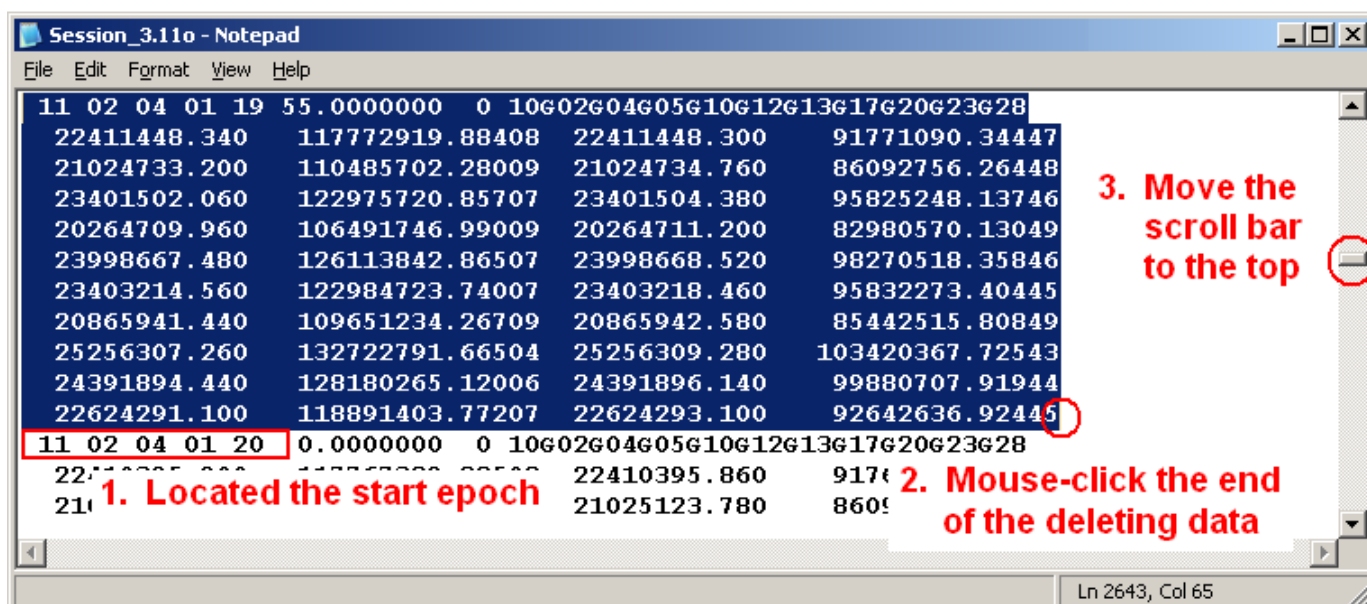
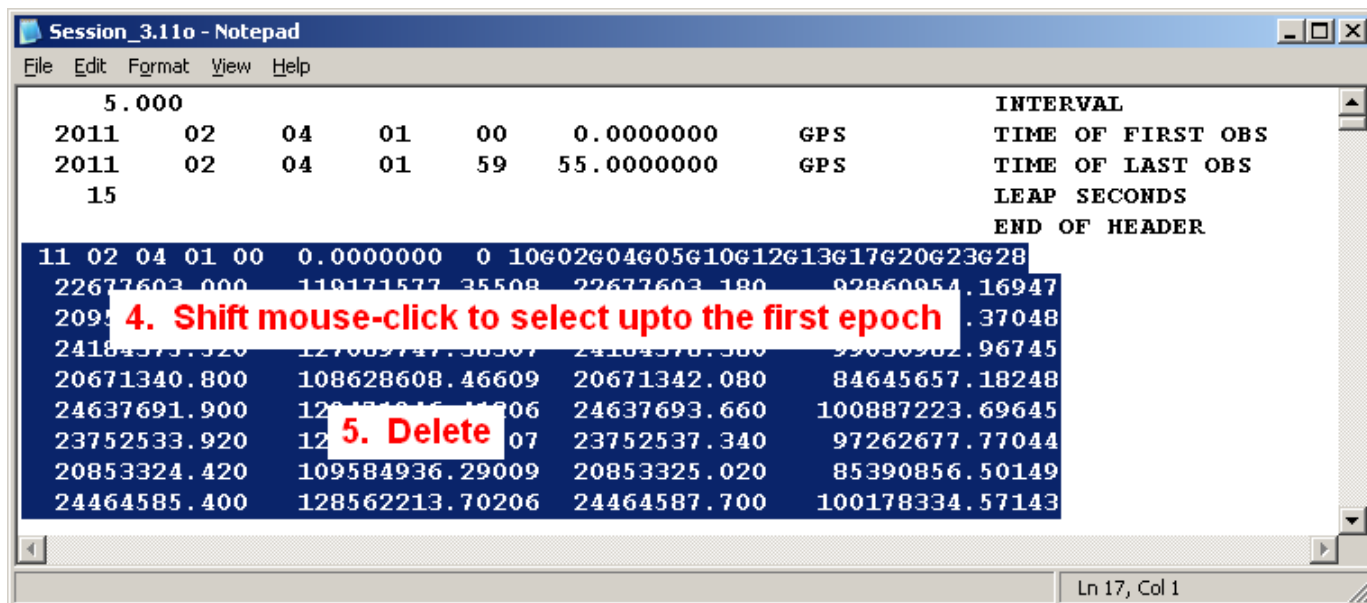
Direction: Up Down

Match case

Find Next Cancel

Ln 13, Col 1

Delete those useless data



```

Case_04 - z8_Result_Email.txt - Notepad
File Edit Format View Help

New Station Name: HKST

Computation Accuracy: 10mm + 3ppm

Upload files: 1. Session_1.11o      248K
              2. Session_3.11o      311K

Reference Station
-----
No.  Station      Latitude (N)      Longitude (E)      Ell.Height
-----
1    HKFN         22^ 29' 40.87008"  114^ 08' 17.40609"  41.210m
2    HKKT         22^ 26' 41.66174"  114^ 03' 59.63436"  34.557m
3    HKLT         22^ 25' 05.28272"  113^ 59' 47.84432"  125.935m
-----

Observation Session
-----
Sess  Start(HKT)      End(HKT)      Duration      Lapse
-----
1    2011-01-12 08:20  2011-01-12 08:49  00:30 (Pass)
2    2011-02-04 09:19  2011-02-04 09:59  00:40 (Pass)  00:30 (Pass)
-----
Ln 1, Col 1

```

R.6 Common Problem – Marker Name Not the Same New Station

New Station Name: 0003 **Station name (MARKER NAME) in the first obs file**

File name and size

Upload files: 1. 00033281.11o 184Kb 0003
 2. 00063281.11o 162Kb 0006 **Station names (MARKER NAME)**

```
*****
*MARKER NAME - Not the same new station '0003' <> '0006' *
*****
```

00033281 - 記事本


檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)

2	OBSERVATION DATA	G	RINEX VERSION / TYPE		
LEICA GEO OFFICE 7.0		24-11-11 14:45	PGM / RUN BY / DATE		
0003			OBSERVER / AGENCY		
0003			MARKER NAME		
311402	LEICA ATX1230	5.63	MARKER NUMBER		
	LEIATX1230		REC # / TYPE / VERS		
			ANT # / TYPE		
	-2417735.9118	5378412.2192	2422468.7113	APPROX POSITION XYZ	
	1.4930	0.0000	0.0000	ANTENNA: DELTA H/E/N	
L1Pha0ff:	0.0888	L2Pha0ff:	0.0885	COMMENT	
1	1			WAVELENGTH FACT L1/2	
6	C1	L1	D1	P2	L2
					D2
2011	11	24	2	11	20.000000
					TIME OF FIRST OBS

00063281 - 記事本

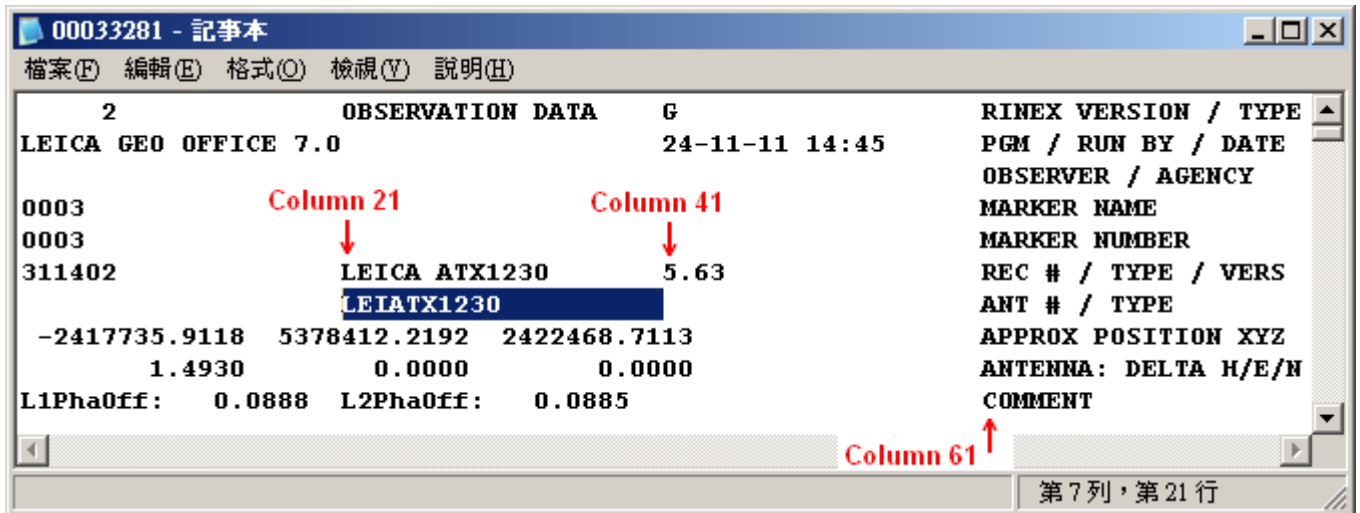
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)

2	OBSERVATION DATA	G	RINEX VERSION / TYPE		
LEICA GEO OFFICE 7.0		24-11-11 14:45	PGM / RUN BY / DATE		
0006			OBSERVER / AGENCY		
0006			MARKER NAME		
311402	LEICA ATX1230	5.63	MARKER NUMBER		
	LEIATX1230		REC # / TYPE / VERS		
			ANT # / TYPE		
	-2417731.9140	5378405.1155	2422468.9890	APPROX POSITION XYZ	
	1.4920	0.0000	0.0000	ANTENNA: DELTA H/E/N	
L1Pha0ff:	0.0888	L2Pha0ff:	0.0885	COMMENT	
1	1			WAVELENGTH FACT L1/2	
6	C1	L1	D1	P2	L2
					D2
2011	11	24	3	13	40.000000
					TIME OF FIRST OBS

AutoComp assumes all observation files are the same station if delta X, delta Y and delta Z of APPROX POSITION XYZ are less than 10m, no matter the MARKER NAME are not the same in the observation files, If not, the computation will be terminated – “**MARKER NAME - Not for the same new station**”. Simply use Notepad to edit the MARKER NAME and MARKER NUMBER of the observation files to the same name to force AutoComp to ignore the APPROX POSITION XYZ values. Be careful not to alter header label starting from the column 61.  [See Tips \(T.1\)](#)

R.7 Common Problem – Wrong Antenna Name (Not NGS Standard)

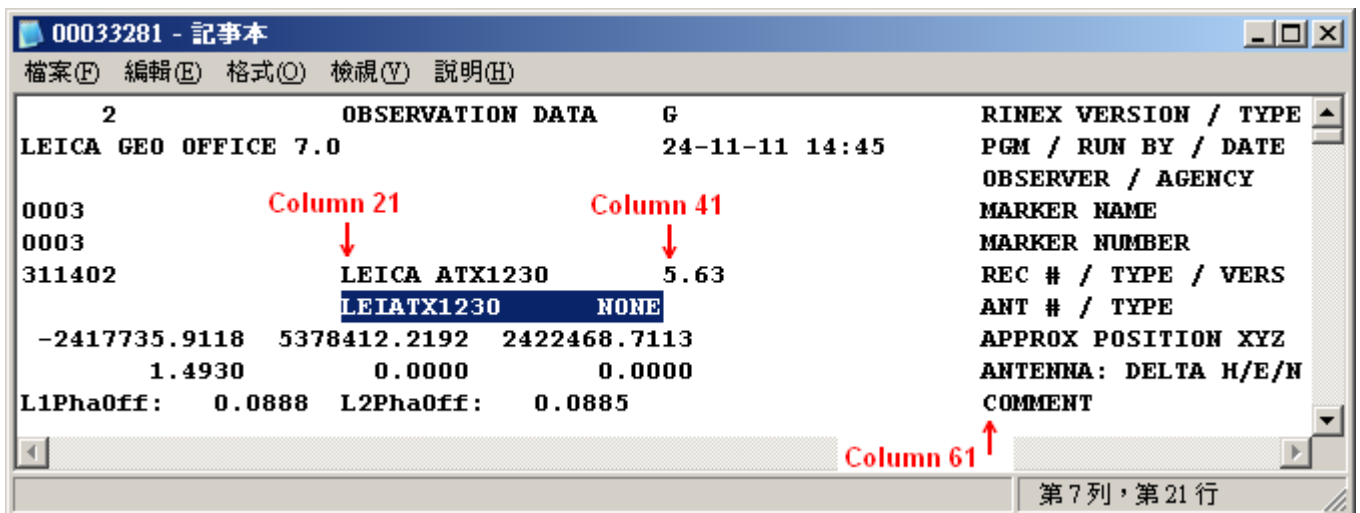
```
*****
* Computation Terminated - Wrong Antenna Name (Not NGS Standard) - 'LEIATX1230' *
*****
```



AutoComp adopts National Geodetic Survey (NGS) antenna name in data processing. To include phase center offsets in the computation, you must strictly follow the NGS antenna name. For the above example, the correct NGS antenna name of Leica ATX1230 is

“LEIATX1230 NONE” (20 characters).

“12345678901234567890”



Please refer to [FAQ - Using NGS Relative Antenna Calibration File in GNSS Baseline Processing](#) to import NGS antenna calibration file to LGO.

S. NGS Antenna Name

No.	NGS Antenna Name	No.	NGS Antenna Name	No.	NGS Antenna Name
1	ACC_G5ANT_52AT1 NONE	48	AOAD/M_B NONE	95	ASH701933C_M SCIT
2	ACC_G5ANT_72AT1 NONE	49	AOAD/M_R NONE	96	ASH701933C_M SNOW
3	ACC123CGNSSA_XN NONE	50	AOAD/M_T NONE	97	ASH701941.1 NONE
4	ACC2G1215A_XT_1 NONE	51	AOAD/M_TA_NGS NONE	98	ASH701941.2 NONE
5	ACC3G1215A_XT_1 NONE	52	AOARASCAL NONE	99	ASH701941.A NONE
6	ACC4G1215A_XT1 NONE	53	APS_APS-3 NONE	100	ASH701941.B NONE
7	ACC4G1215A_XT_1 NONE	54	APS_APS-3 SCIT	101	ASH701945B_M NONE
8	ACC5G1215A_XT1 NONE	55	APSAPS-3L NONE	102	ASH701945B_M SCIS
9	ACC53G01215AXT1 NONE	56	ASH_LOCUS NONE	103	ASH701945B_M SCIT
10	ACC72CGNSSA NONE	57	ASH110454 NONE	104	ASH701945B_M SNOW
11	ACC72GNSSA_XT_1 NONE	58	ASH111660 NONE	105	ASH701945C_M NONE
12	ACCG3ANT_3AT1 NONE	59	ASH111661 NONE	106	ASH701945C_M SCIS
13	ACCG3ANT_42AT1 NONE	60	ASH700228A NONE	107	ASH701945C_M SCIT
14	ACCG3ANT_52AT1 NONE	61	ASH700228B NONE	108	ASH701945C_M SNOW
15	ACCG5ANT_123CAN NONE	62	ASH700228C NONE	109	ASH701945D_M NONE
16	ACCG5ANT_2AT1 NONE	63	ASH700228D NONE	110	ASH701945D_M SCIS
17	ACCG5ANT_3AT1 NONE	64	ASH700228E NONE	111	ASH701945D_M SCIT
18	ACCG5ANT_42AT1 NONE	65	ASH700700.A NONE	112	ASH701945D_M SNOW
19	AERAT1675_120 NONE	66	ASH700700.B NONE	113	ASH701945E_M NONE
20	AERAT1675_120 SPKE	67	ASH700700.C NONE	114	ASH701945E_M SCIS
21	AERAT1675_180 NONE	68	ASH700718A NONE	115	ASH701945E_M SCIT
22	AERAT1675_182 NONE	69	ASH700718B NONE	116	ASH701945E_M SNOW
23	AERAT1675_200 NONE	70	ASH700829.2 SNOW	117	ASH701945G_M NONE
24	AERAT1675_200 SPKE	71	ASH700829.3 SNOW	118	ASH701945G_M SCIS
25	AERAT1675_29 NONE	72	ASH700829.A SNOW	119	ASH701945G_M SCIT
26	AERAT1675_304 NONE	73	ASH700829.A1 SNOW	120	ASH701945G_M SNOW
27	AERAT1675_32 NONE	74	ASH700936A_M NONE	121	ASH701946.2 NONE
28	AERAT1675_382 NONE	75	ASH700936A_M SNOW	122	ASH701946.3 NONE
29	AERAT1675_39 NONE	76	ASH700936B_M NONE	123	ASH701975.01A NONE
30	AERAT1675_504 NONE	77	ASH700936B_M SNOW	124	ASH701975.01AGP NONE
31	AERAT1675_80 NONE	78	ASH700936C_M NONE	125	ASH701975.01B NONE
32	AERAT1675_81 NONE	79	ASH700936C_M SNOW	126	ASH701975.01BGP NONE
33	AERAT2775_150 NONE	80	ASH700936D_M NONE	127	ASH802129 NONE
34	AERAT2775_159 NONE	81	ASH700936D_M SCIS	128	ASH802147_A NONE
35	AERAT2775_159 SPKE	82	ASH700936D_M SNOW	129	CHANV3 NONE
36	AERAT2775_160 NONE	83	ASH700936E NONE	130	CHATKO NONE
37	AERAT2775_270 NONE	84	ASH700936E_C NONE	131	CHCA300GNSS NONE
38	AERAT2775_382 NONE	85	ASH700936E_C SNOW	132	CHCC220GR CHCD
39	AERAT2775_41 NONE	86	ASH701008.01B NONE	133	CHCX900B NONE
40	AERAT2775_42 NONE	87	ASH701073.1 NONE	134	CHCX900R NONE
41	AERAT2775_42+CR NONE	88	ASH701073.3 NONE	135	CHCX90D-OPUS NONE
42	AERAT2775_43 NONE	89	ASH701933A_M NONE	136	CHCX91B NONE
43	AERAT2775_43 SPKE	90	ASH701933A_M SNOW	137	CHCX91R NONE
44	AERAT2775_443 NONE	91	ASH701933B_M NONE	138	DGR_QEDGE NONE
45	AERAT2775_443 SPKE	92	ASH701933B_M SNOW	139	GUTGPSL1L2A NONE
46	AERAT2775_62 NONE	93	ASH701933C_M NONE	140	HEMA21 NONE
47	AOA7490582.2 NONE	94	ASH701933C_M SCIS	141	HEMA325 NONE

No.	NGS Antenna Name	No.	NGS Antenna Name	No.	NGS Antenna Name
142	HEMA42 NONE	192	LEIAR25.R3 SCIT	242	NOV501 NONE
143	HEMA52_WB NONE	193	LEIAR25.R4 LEIT	243	NOV501+CR NONE
144	HEMS320 NONE	194	LEIAR25.R4 NONE	244	NOV502 NONE
145	HITV30 NONE	195	LEIAR25.R4 SCIS	245	NOV502+CR NONE
146	HXCGG486A HXCS	196	LEIAR25.R4 SCIT	246	NOV503+CR NONE
147	HXCGG486A NONE	197	LEIAS10 NONE	247	NOV503+CR SPKE
148	HXCGS488A NONE	198	LEIAT202-GP NONE	248	NOV512 NONE
149	ITT3750323 NONE	199	LEIAT302-GP NONE	249	NOV531 NONE
150	ITT3750323 SCIS	200	LEIAT303 LEIC	250	NOV531+CR NONE
151	JAV_GRANT-G3T NONE	201	LEIAT303 NONE	251	NOV533 RADM
152	JAV_GRANT-G3T+G JVGR	202	LEIAT502 NONE	252	NOV600 NONE
153	JAV_GRANT-G3T+G NONE	203	LEIAT503 LEIC	253	NOV701GG_1.03 NONE
154	JAV_RINGANT_G3T JAVC	204	LEIAT503 NONE	254	NOV701GGL NONE
155	JAV_RINGANT_G3T NONE	205	LEIAT504 LEIS	255	NOV702_2.02 NONE
156	JAV_TRIUMPH-1 NONE	206	LEIAT504 NONE	256	NOV702_3.00 NONE
157	JAV_TRIUMPH-1R NONE	207	LEIAT504GG LEIS	257	NOV702GG NONE
158	JAVGISMORE NONE	208	LEIAT504GG NONE	258	NOV702GG_1.02 NONE
159	JAVGRANT_G3 NONE	209	LEIAT504GG SCIS	259	NOV702GG_1.03 NONE
160	JAVGRANT_G3+GP JVGR	210	LEIAT504GG SCIT	260	NOV702GGL_1.01 NONE
161	JAVGRANT_G3+GP NONE	211	LEIATX1230 NONE	261	NOV702L_1.01 NONE
162	JAVGRANT_G3TJ NONE	212	LEIATX1230GG NONE	262	NOV702L_1.03 NONE
163	JAVGRANT_G3TJ+G JVGR	213	LEIAX1202 NONE	263	NOV750.R4 NONE
164	JAVGRANT_G3TJ+G NONE	214	LEIAX1202A NONE	264	NOV750.R4 NOVS
165	JAVRINGANT_DM JVDM	215	LEIAX1202GG NONE	265	NOV750.R4 SCIS
166	JAVRINGANT_DM NONE	216	LEIAX1203+GNSS NONE	266	NOV750.R4 SCIT
167	JAVRINGANT_DM SCIS	217	LEIGS08PLUS NONE	267	SEN67157514 NONE
168	JAVRINGANT_DM SCIT	218	LEIGS15 NONE	268	SEN67157514+CR NONE
169	JAVTRIANT NONE	219	LEISR299_INT NONE	269	SEN67157549 NONE
170	JAVTRIUMPH_VS NONE	220	LEISR399_INT NONE	270	SEN67157549+CR NONE
171	JNSCHOKERING_DM NONE	221	LEISR399_INTA NONE	271	SEN67157596 NONE
172	JNSCR_C146-22-1 NONE	222	MAC4647942 MMAC	272	SEN67157596+CR NONE
173	JNSCR_C146-22-1 SCIS	223	MAG105645 NONE	273	SEP_POLANT+ NONE
174	JNSMARANT_GGD NONE	224	MAG111406 NONE	274	SEP_POLANT+_GG NONE
175	JPLD/M_R NONE	225	MAG990596 NONE	275	SEPPOLANT_X_MF NONE
176	JPSLEGANT_E NONE	226	MPL_WAAS_2224NW NONE	276	SEPPOLANT_X_SF NONE
177	JPSMARANT_GGD NONE	227	MPL_WAAS_2225NW NONE	277	SMICR3B NONE
178	JPSODYSEY_I NONE	228	MPL1230 NONE	278	SMICR3B SPKE
179	JPSREGANT_DD_E NONE	229	MPL1370W NONE	279	SOK_GSR2700IS NONE
180	JPSREGANT_SD_E NONE	230	NAV_ANT3001BR SPKE	280	SOK_GSR2700ISX NONE
181	KOLK9_T NONE	231	NAV_ANT3001R NONE	281	SOK_LOCUS NONE
182	LEIAR10 NONE	232	NAVAN2004T NONE	282	SOK_RADIAN_IS NONE
183	LEIAR20 LEIM	233	NAVAN2008T NONE	283	SOK502 NONE
184	LEIAR20 NONE	234	NAVANT3001A NONE	284	SOK600 NONE
185	LEIAR25 LEIT	235	NAVANT3001B NONE	285	SOK702 NONE
186	LEIAR25 NONE	236	NAVRT3010S NONE	286	SOKA110 NONE
187	LEIAR25 SCIS	237	NAVVF2040G NONE	287	SOKA120 NONE
188	LEIAR25 SCIT	238	NAVVF3040 NONE	288	SOKGRX1 NONE
189	LEIAR25.R3 LEIT	239	NGSD/M+GP60 NONE	289	SOKGRX1+10 NONE
190	LEIAR25.R3 NONE	240	NONE	290	SOKGRX2 NONE
191	LEIAR25.R3 SCIS	241	NOV_WAAS_600 NONE	291	SOKGRX2+10 NONE

No.	NGS Antenna Name	No.	NGS Antenna Name	No.	NGS Antenna Name
292	SOKGSX2 NONE	333	TPSHIPER_II NONE	373	TRM27947.00+GP NONE
293	SOKGSX2+10 NONE	334	TPSHIPER_II+10 NONE	374	TRM27947.00-GP NONE
294	SOKSTRATUS NONE	335	TPSHIPER_LITE NONE	375	TRM29659.00 NONE
295	SPP39105.90 NONE	336	TPSHIPER_PLUS NONE	376	TRM29659.00 SCIS
296	SPP571212238+GP NONE	337	TPSHIPER_SR NONE	377	TRM29659.00 SCIT
297	SPP571908273+CR NONE	338	TPSHIPER_SR+10 NONE	378	TRM29659.00 UNAV
298	SPP571908273+CR SPKE	339	TPSHIPER_V NONE	379	TRM33429.00+GP NONE
299	SPP67410_42 NONE	340	TPSHIPER_V+10 NONE	380	TRM33429.00-GP NONE
300	SPP67410_44 NONE	341	TPSHIPER_XT NONE	381	TRM33429.20+GP NONE
301	SPP67410_46 NONE	342	TPSLEGANT NONE	382	TRM33429.20+GP TCWD
302	SPP68410_10 NONE	343	TPSLEGANT_G NONE	383	TRM33429.20+GP UNAV
303	SPP89823_10 NONE	344	TPSLEGANT2 NONE	384	TRM36569.00+GP NONE
304	STHS82_7224V3.0 NONE	345	TPSLEGANT3_UHF NONE	385	TRM39105.00 NONE
305	STHS86_7224V3.1 NONE	346	TPSMAPANT_B NONE	386	TRM41249.00 NONE
306	THA800961+REC NONE	347	TPSMG_A2 NONE	387	TRM41249.00 SCIT
307	THA800961+RTK NONE	348	TPSODYSSEY_I NONE	388	TRM41249.00 TZGD
308	THA800961RECUHF NONE	349	TPSPG_A1 NONE	389	TRM41249USCG SCIT
309	THA800961RTKUHF NONE	350	TPSPG_A1 TPSD	390	TRM4800 NONE
310	THANAP002 NONE	351	TPSPG_A1_6 NONE	391	TRM49700.00 NONE
311	TOP72110 NONE	352	TPSPG_A1_6+GP NONE	392	TRM53406.00 NONE
312	TPS_CR.3 SCIS	353	TPSPG_A1+GP NONE	393	TRM55970.00 NONE
313	TPS_CR4+RD SCIS	354	TPSPG_A2 NONE	394	TRM55971.00 NONE
314	TPS_MC.A5 NONE	355	TPSPG_A5 NONE	395	TRM55971.00 SCIT
315	TPSCR.G3 NONE	356	TPSPG_F1 NONE	396	TRM55971.00 TZGD
316	TPSCR.G3 SCIS	357	TPSPG_F1+GP NONE	397	TRM57970.00 NONE
317	TPSCR.G3 SCIT	358	TPSPG_S1 NONE	398	TRM57971.00 NONE
318	TPSCR.G3 TPSH	359	TPSPG_S1+GP NONE	399	TRM5800 NONE
319	TPSCR.G5 NONE	360	TPSPN.A5 NONE	400	TRM59800.00 NONE
320	TPSCR.G5 SCIS	361	TPSPN.A5 SCIS	401	TRM59800.00 SCIS
321	TPSCR.G5 SCIT	362	TPSPN.A5 SCIT	402	TRM59800.00 SCIT
322	TPSCR.G5 TPSH	363	TPSPN.A5 TPSH	403	TRM59800.80 NONE
323	TPSCR3_GGD CONE	364	TRM_R6 NONE	404	TRM59800.80 SCIS
324	TPSCR3_GGD NONE	365	TRM_R8 NONE	405	TRM59800.80 SCIT
325	TPSCR4 CONE	366	TRM_R8_GNSS NONE	406	TRMA3_L1 NONE
326	TPSCR4 NONE	367	TRM14532.00 NONE	407	TRMR4-2 NONE
327	TPSG3_A1 NONE	368	TRM14532.10 NONE	408	TRMR6 NONE
328	TPSG3_A1 TPSD	369	TRM22020.00+GP NONE	409	TRMR6-2 NONE
329	TPSGR3 NONE	370	TRM22020.00-GP NONE	410	TRMR6-3 NONE
330	TPSGR5 NONE	371	TRM22020.02 TCWD	411	TRMR8 NONE
331	TPSHIPER_GD NONE	372	TRM23903.00 NONE	412	TRMR8_GNSS NONE
332	TPSHIPER_GGD NONE				

Notes: 1. Refer NGS 16 May 2013 database.

2. AutoComp supports both “NONE” or no “NONE” antenna names,

e.g. “TRMR8_GNSS3 ” and

“TRMR8_GNSS3 NONE” are the same.

“12345678901234567890” (20 characters each)

T.1 Tips – Upload Multiple Station Data Files

Although rejection email “MARKER NAME - Not the same new station” will be sent to you if you uploaded multiple station files,

```
=====
Hong Kong Satellite Positioning Reference Station Network
GPS Automatic Computation Service
=====

Applicant: TM DSO <ChanTai-Man@hotmail.com>

Request: 2012-02-27 12:39:52 (HKT)
Process: 2012-02-27 17:54:07 (HKT)

New Station Name: LP1

Computation Accuracy: 10mm + 3ppm

Upload files: 1. LP1_0450.12o    280Kb  LP1
               2. LP1_0451.12o    247Kb  LP1
               3. N1_S0460.12o    118Kb  N1
               4. N1_S0461.12o    125Kb  N1
               5. N2_S0450.12o    237Kb  N2
               6. N2_S0451.12o    237Kb  N2

*****
* Computation Terminated - MARKER NAME - Not the same new station 'LP1' <> 'N2' *
*****
```

AutoComp tries to process your observation files as far as possible. For the above example, AutoComp computes the 6 observation files in 3 separate processes to get the result of 3 stations.

T.2 Tips – Auto Divide One Long Observation File into Two

SatRef GPS Automatic Computation Service - Acknowledgement

▣ SatRef-CA1

To chantai-man@hotmail.com

The following file is received on 2011-11-23 16:30:00

1. USM2.11o 706 Kb **Only one session is uploaded**

Selected Options:

Reference Station = Nearest 3

Computation Accuracy = 10mm+3ppm

Minimum No. of Reference Station = 2

Minimum No. of Session = 2

Minimum Duration = 15 min. **Session criterion**

Minimum Interval = 30 min.

Minimum No. of Baseline = 3

Maximum GDOP = 5.0

Epoch Rate = 5 sec.

Divide Observation file for every = N.A.

Land Boundary Survey Standard = True

Check Origin = True

Reject Large GDOP = True

If the duration of the only one uploaded session is long enough, AutoComp will divide the uploaded file into 2 session files with required time lapse.

Upload files: 1. 1_USM2.11o 196Kb
2. 2_USM2.11o 226Kb

Your obs file 'USM2.11o' was divided into 2 session-files

Observation Session

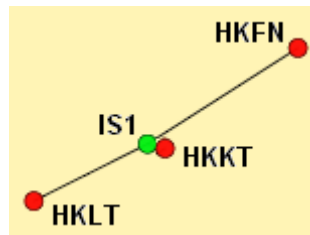
Sess	Start (HKT)	End (HKT)	Duration	Lapse
1	2011-06-09 11:38	2011-06-09 12:04	00:26 (Pass)	
2	2011-06-09 12:34	2011-06-09 13:00	00:26 (Pass)	00:30 (Pass)

T.3 Tips – Adjust Elevation Mask to Include More Observations

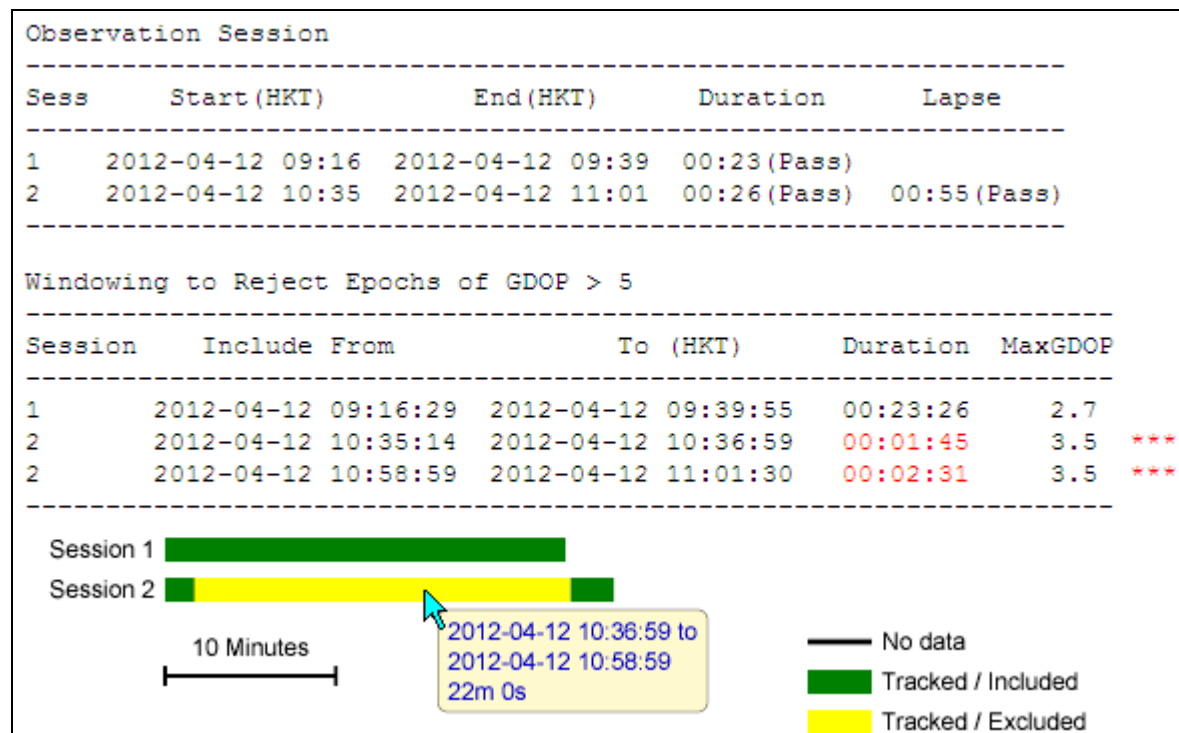
Apparently, this computation meets all requirements and has a good result.

```

*   Final Result - IS1
*
*   WGS84 (ITRF96) Geodetic Coordinates
*   -----
*   Latitude   = 22^ 26' 48.16786" N   Standard Error = 1.7mm
*   Longitude  = 114^ 03' 27.13471" E   Standard Error = 1.8mm
*   Ell Height = 0.5383m                 Standard Error = 5.0mm
*
*   Hong Kong 1980 Grid Coordinates (By Two Step Transformation)
*   -----
*   Northing  = 834146.979m
*   Easting   = 823983.961m
*   Height    =      4.071m (for reference only)
*
*   The station 'IS1' is
*   - fixed by 6 independent GPS baselines      (at least 3)
*   - connected to 3 SatRef GPS stations        (at least 2)
*   - obtained from 2 observation sessions      (at least 2)
*   - computed by following baselines (sessions)
*     ~ HKFN 12 (9.9km)
*     ~ HKKT 12 (1.0km)
*     ~ HKLT 12 (7.0km)
*
*   Computation Accuracy      : 10mm + 3ppm
*   Minimum Session Duration  : 15 minutes
*   Minimum Session Lapse     : 30 minutes
*   Elevation Mask            : 15 degrees
*   Reject GDOP Exceed       : 5
  
```



However, it remained only 4 minutes data in session 2 as some 22 minutes data were excluded (windowing) due to GDOP larger than 5.



GDOP.csv, Elevation1.txt and Elevation2.txt give you important information.

	A	B	D	E	F	G	H
1	Sess	Start (GPS Time)	End	MaxGDOP	MaxHDOP	MaxVDOP	Remark
2	1	2012-04-12 1:16:29	1:39:55	2.7	0.9	2.1	Whole Session
3	2	2012-04-12 2:35:14	3:01:30	300	83.4	209.1	Whole Session
4	2	2012-04-12 2:35:14	2:36:59	3.5	1.6	2.5	
5	2	2012-04-12 2:36:59	2:37:58	21.8	5.7	15.4	Reject GDOP>5.0
6	2	2012-04-12 2:38:00	2:38:59	23.8	6.3	16.8	Reject GDOP>5.0
7	2	2012-04-12 2:39:00	2:39:59	26.3	7	18.5	Reject GDOP>5.0
8	2	2012-04-12 2:39:59	2:40:58	29.4	7.8	20.7	Reject GDOP>5.0
9	2	2012-04-12 2:41:00	2:41:59	33.3	8.9	23.4	Reject GDOP>5.0
10	2	2012-04-12 2:42:00	2:42:59	38.5	10.3	27.1	Reject GDOP>5.0
11	2	2012-04-12 2:42:59	2:43:58	45.7	12.3	32.1	Reject GDOP>5.0
12	2	2012-04-12 2:44:00	2:44:58	56.4	15.3	39.5	Reject GDOP>5.0
13	2	2012-04-12 2:45:00	2:45:59	73.5	20.1	51.4	Reject GDOP>5.0
14	2	2012-04-12 2:45:59	2:46:58	104.8	28.8	73.2	Reject GDOP>5.0
15	2	2012-04-12 2:46:59	2:47:58	174.7	48.3	122	Reject GDOP>5.0
16	2	2012-04-12 2:48:00	2:48:59	300.1	83.4	209.3	Reject GDOP>5.0
17	2	2012-04-12 2:48:59	2:49:58	300	83.4	209.1	Reject GDOP>5.0
18	2	2012-04-12 2:49:59	2:50:58	173.7	48.6	121	Reject GDOP>5.0
19	2	2012-04-12 2:51:00	2:51:59	103.5	29.1	72	Reject GDOP>5.0
20	2	2012-04-12 2:51:59	2:52:59	72.1	20.4	50.1	Reject GDOP>5.0
21	2	2012-04-12 2:52:59	2:53:58	55	15.7	38.2	Reject GDOP>5.0
22	2	2012-04-12 2:54:00	2:54:59	44.4	12.7	30.8	Reject GDOP>5.0
23	2	2012-04-12 2:55:00	2:55:59	37.1	10.7	25.7	Reject GDOP>5.0
24	2	2012-04-12 2:55:59	2:56:58	31.9	9.3	22.1	Reject GDOP>5.0
25	2	2012-04-12 2:57:00	2:57:59	28	8.2	19.3	Reject GDOP>5.0
26	2	2012-04-12 2:58:00	2:58:59	24.9	7.3	17.2	Reject GDOP>5.0
27	2	2012-04-12 2:58:59	2:59:58	3.4	1.6	2.4	
28	2	2012-04-12 3:00:00	3:01:30	2.4	1.2	1.7	

Elevation1.txt

Satellite Elevation and Epoch by TEQC

```

-----
Session                No.  SV      No. of Epoch  Elevation  >=15
-----
2.  2012-04-12 10:35   1    G22         104         9.0        No
                               2    G05         130         9.4        No
                               3    G29         269        12.2        No
                               4    G14         286        12.5        No
                               5    G12         288        12.6        No
-----
                               1    G18         316        43.0        Yes
                               2    G15         316        43.1        Yes
                               3    G27         316        54.3        Yes
                               4    G21         316        63.5        Yes
                               5    G09         316        73.2        Yes
-----

```

Elevation1.txt tells you 5 GPS satellites are above 15 degrees and another 3 GPS satellites are around 12 degrees.

Elevation2.txt

Check Elevation Mask and Satellite by LGO SPP

Sess	>=	GDOP	GPS	GLO	L1Obs	Satellite List
2	0	2.4	10	0	2657	G5,G9,G12,G14,G15,G18,G21,G22,G27,G29
	5	2.4	10	0	2657	G5,G9,G12,G14,G15,G18,G21,G22,G27,G29
	6	2.4	10	0	2657	G5,G9,G12,G14,G15,G18,G21,G22,G27,G29
	7	2.4	10	0	2657	G5,G9,G12,G14,G15,G18,G21,G22,G27,G29
	8	2.4	10	0	2657	G5,G9,G12,G14,G15,G18,G21,G22,G27,G29
	9	2.4	10	0	2657	G5,G9,G12,G14,G15,G18,G21,G22,G27,G29
	10	2.4	10	0	2637	G5,G9,G12,G14,G15,G18,G21,G22,G27,G29
	11	3.2	10	0	2390	G5,G9,G12,G14,G15,G18,G21,G22,G27,G29
	12	3.4	10	0	2151	G5,G9,G12,G14,G15,G18,G21,G22,G27,G29
	13	300.0	8	0	1959	G9,G12,G14,G15,G18,G21,G27,G29
	14	300.0	8	0	1814	G9,G12,G14,G15,G18,G21,G27,G29
	15	300.0	8	0	1668	G9,G12,G14,G15,G18,G21,G27,G29

Elevation2.txt tells the SPP (Single Point Positioning) computed very poor GDOP at elevation mask settings at 13 to 15 degrees.

GDOP less than 5 is a recommended practice in LBS GPS Spec, not a mandatory requirement. Think about releasing this recommended GDOP value to 12 degrees to include more observation epochs for computation.

Step 4: Select the Computation and Other Setting:

Adopt [Land Boundary Surveys \(Code of Practice\)](#) Standard

- Allowable Maximum GDOP Value:
- Minimum Session: (session)
- Session Minimum Time Duration: (mins)
- Minimum Time Interval Between Sessions: (mins)
- Epoch Rate : (s)
- Elevation Mask : (degree)
- Require Check Origin :

Click to browse [result of Elevation Mask = 15](#)

Northing = 834146.979m
Easting = 823983.961m
Height = 4.071m

Click to browse [result of Elevation Mask = 12](#)

Northing = 834146.979m
Easting = 823983.960m
Height = 4.072m

T.4 Tips – Accuracy Standard and Allowable

According to the [Specifications and Practice Guide for Establishing GPS Control Stations for Land Boundary Surveys Version 2.0](#) (LBS GPS Spec), the required accuracy standard is 10mm+3ppm for land boundary survey. The standard error of any GPS baseline measurement shall not exceed σ (sigma), where $\sigma = \sqrt{[10^2 + (3 \times L)^2]}$ mm or maximum 30mm (L = length of baseline in km)

The standard error (or simply sigma) is not solely defined by the length of the baseline, but also limited by a maximum value 30mm for LBS 10mm+3ppm.

Example 1

A 10km baseline the sigma is $\sqrt{[10^2 + (3 \times 10)^2]} = 31.6$ mm, which is greater than the maximum 30mm, so the adopted sigma is 30mm.

Example 2

The distance between HKFN to HKLT is 16.9km, by calculation 1 sigma = 51.7mm, which is greater than 30mm, so the allowable for origin checking 2 sigma is 60mm, not 103.4mm

Checking Origin - Misclosure Summary					
Session	Origin	Length	Latitude	Longitude	Allowable
1	HKFN - HKKT	9.2km	21.0mm	37.7mm	58.7mm Pass
	HKFN - HKLT	16.9	6.9	9.6	60.0 Pass
	HKKT - HKLT	7.8	23.0	5.6	50.8 Pass

Accuracy: 10mm+3ppm $\sigma = \sqrt{[10^2 + (3 \times 16.9)^2]} = 51.7$
Max $\sigma = 30$
Allowable = 2 $\sigma = 60$ mm

Example 3

For a baseline of 5.587km, by calculation 1 sigma = 19.5mm, which is smaller than 30mm, so the allowable for repeated baseline checking $2\sqrt{2}\sigma$ is 55.2mm

Repeated Baseline Summary					
Sess	GDOP	Delta Lat	Delta Long	Delta Ht	Remarks
HKFN - KL2					
1	3.9	-0'05.15344"	-3'15.38894"	-33.8539	Pass
2	4.0	-0'05.15419"	-3'15.38912"	-33.8629	
Spread:		22.5mm	5.4mm	2 Baselines	
Allowable:		55.2mm	55.2mm	L=5.587km	

Accuracy: 10mm+3ppm $\sigma = \sqrt{[10^2 + (3 \times 5.587)^2]} = 19.5$
Allowable = $2\sqrt{2}\sigma = 55.2$ mm

Example 4

For a baseline of 12.2km, by calculation 1 sigma = 37.9mm, which is greater than 30mm, so the allowable residual for horizontal component in network adjustment 2 sigma is still 60mm, not 75.8mm

Least Squares Network Adjustment - Residuals Report (Final)									
Baseline	Session	Input (m)	Std Err (mm)	--Residual--		Allowable ENH			
				XYZ	ENH				
1	HKLT - KL2	2	DX	-6864.4883	18.0	-14.8	-52.5	60.0	Pass
			DY	-6661.1214	32.9	162.3	48.5	60.0	Pass
			DZ	7642.7248	19.3	116.2	186.9		
			DV	12243.4873					

Maximum sigma limitation is a control of the achieved accuracy of long baseline. Without the maximum sigma limitation, a 20 km baseline will have a very large sigma of 61mm. (*Don't kidding to run a longer traverse if not close.*) However, if you are not doing land boundary survey, depending on the nature of works, such as topographic or engineering surveys, and subject to professional decision, you may release the accuracy standard and/or the maximum 1 sigma limitation.

Step 3: Select the Computation Precision:

Please select the computation precision:

? mm : Please enter (mm)

? ppm: Please enter (ppm)

- 10 mm + 3 ppm
- 5 mm + 1 ppm
- 3 mm + 1 ppm
- ? mm + ? ppm
- ? mm

Step 4: Select the Computation and Other Setting:

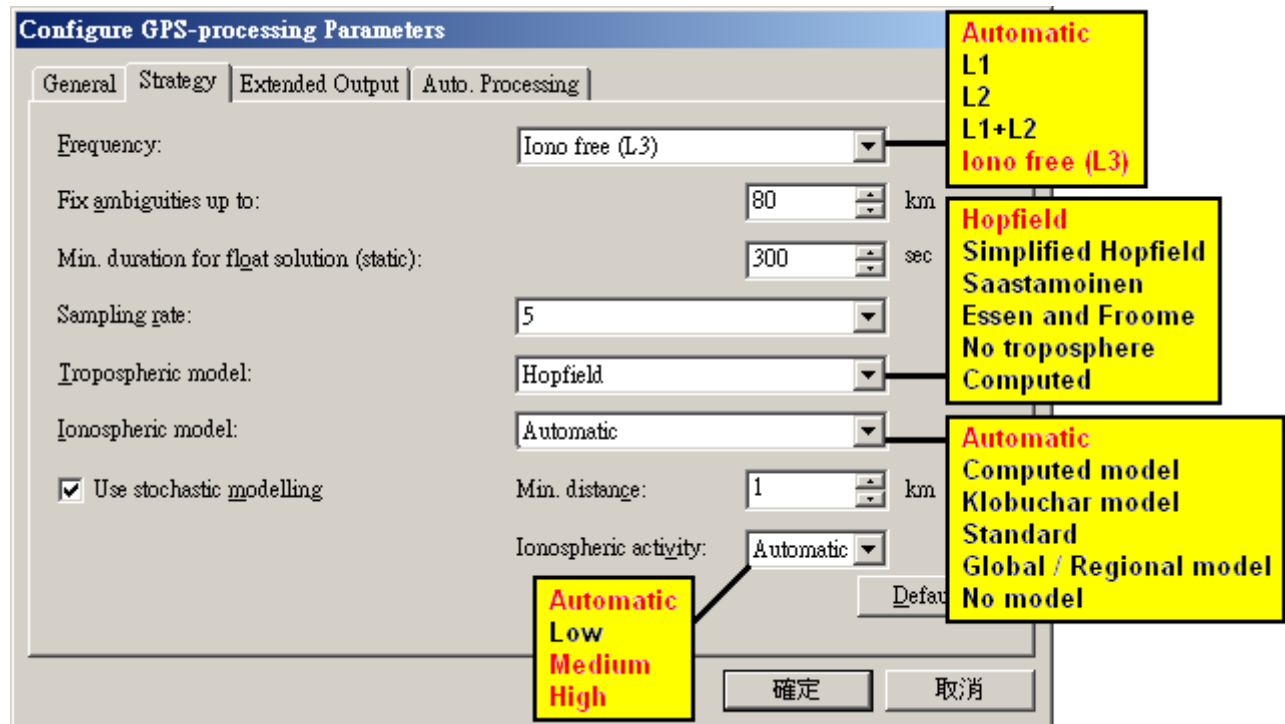
Adopt Land Boundary Surveys (Code of Practice) Standard

- Allowable Maximum GDOP Value:
- Minimum Session: (session)
- Session Minimum Time Duration: (mins)
- Minimum Time Interval Between Sessions: (mins)
- Epoch Rate: (s)
- Elevation Mask: (degree)
- Require Check Origin:
- Maximum 1 Sigma (Accuracy Standard): (mm)

- 30
- 40
- 50
- 60
- 100
- 999

T.5 Tips – GPS Baseline Processing: Frequency Strategy

AutoComp adopts following shown default processing settings and the optional settings (in red)



Frequency:

➤ Automatic

- LGO automatically selects the best frequency or combination of frequencies for the final solution. If dual-frequency data (L1+L2) is available both frequencies will typically be used. If the data additionally offers the L5 frequency, then L5 will be included in the computation.
- Because signal delay through the ionosphere is different for the L1 and L2 frequency, a linear combination of the two frequencies, which eliminates the influence of the ionosphere can be calculated. However, this so-called ionospheric-free L3 solution also destroys the integer nature of the ambiguities.
- If L1 and L2 ambiguities can be resolved previously, a second processing run can be started introducing the fixed L1 and L2 integer ambiguities into the ionospheric-free L3 linear combination. Ionospheric disturbances are eliminated while fixed ambiguities are used. This strategy is preferably used when ambiguities can be resolved but the ionospheric influence is significant (e.g. with baselines >15 km).
- With short baselines (< 15 km), though, using the ionospheric-free linear combination would increase the noise with little benefit. A standard L1+L2 solution is best used then.
- LGO uses an L3 solution ionospheric-free L3 solution if the baselines >15 km.

➤ Iono free (L3)

- Makes the system compute an L3 solution independent of the baseline length

Ionospheric model:

➤ Automatic

- The system default is Automatic. LGO selects a model to be used according to the duration of the sessions without you having to interfere and decide on a specific model. For observation times on the reference longer than 45 min. your own ionospheric model may be computed, so that automatically the option Computed model will be taken, whereas with shorter observation periods the Klobuchar model will be preferred. If no almanac is available, though, No model will be used with observation times below 45 min.

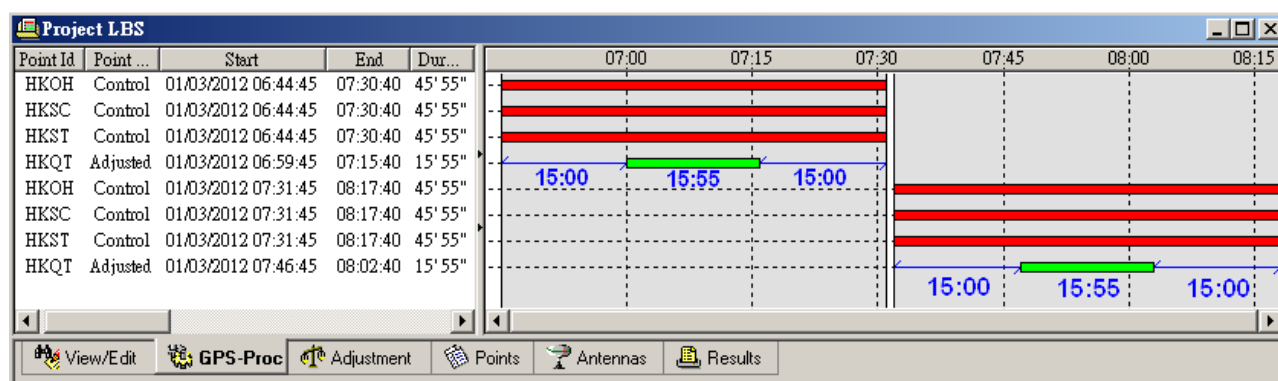
➤ Computed model

- If Computed model is selected and if the user has at least 45 minutes of static or rapid-static dual-frequency data collected at the reference station, LGO will compute an ionospheric model. This is advantageous, as the model computed is in accordance with conditions prevalent at the time and position of observation. If this model has been selected manually, but less than 45 minutes of data are available the processing parameters will automatically be switched to No model.

➤ Klobuchar model

- The Klobuchar model reflects the 11-year cycle of solar activity particularly well and can be advantageous during the time of high solar activity. The Klobuchar model should only be selected if observation data from Leica receivers is being used to process, since this kind of data contains the necessary almanac files. If the observation data has been imported via RINEX and the Klobuchar model is selected, the processing parameters automatically switch to No model because of the missing almanac.

AutoComp adopts Automatic ionospheric model. If the uploaded rover observation files meet the minimum requirements of the LBS GPS Spec, i.e. two minimum 15-minute observation sessions with 30-minute time lapse, AutoComp will call reference station observation files with additional 15 minutes before and after the rover's observation sessions.



There will be at least 45 minutes observation data at the reference stations, sufficient for LGO to compute an ionospheric model. In case if computed model could not be generated, the Klobuchar model would be used automatically.

Use stochastic modelling:

- Select this option if you want to model the ionosphere additionally by calculating the ionospheric impact for each epoch. Stochastic modelling supports ambiguity resolution on medium and longer baselines when you suspect the ionosphere to be quite active. You should, however, be careful with short baselines since bad data -- e.g. influenced by multipath or obstructions -- may be misinterpreted as being influenced by ionospheric noise.
- Thus, it is recommended to leave the default value for the Min. distance set to 8 km. With shorter baselines the ionospheric influence is smaller and stochastic modelling is not necessary.
- It is advisable to leave the Ionospheric activity option set to Automatic. LGO will then, depending on the baseline length, automatically set the level by which the changing of the ionospheric activity from epoch to epoch is modelled. You may set the Ionospheric activity parameter manually to Low, Medium or High, if you have reliable indications on the current ionospheric activity.

Based on LGO different settings, AutoComp builds up two frequency strategies: (1) **L3 Preference** and (2) **Auto Preference** in baseline processing.

Strategy	L3 Preference	Auto Preference	
Trial No.	Frequency		Ionospheric Activity
1	Iono Free (L3)	Automatic	Automatic
2	Automatic	Iono Free (L3)	Automatic
3	Iono Free (L3)	Iono Free (L3)	High
4	Iono Free (L3)	Iono Free (L3)	Medium

Hong Kong is located in the high ionospheric activity zone, using Iono free (L3) frequency even for short baseline less than 15 km may be useful. AutoComp uses both frequency strategies to processes baselines for every submission. Minimum distance of 1 km for stochastic modeling is also chosen to calculate the ionospheric impact for each epoch.

Users are advised to analyze (1) the checking origin result, (2) the computed standard error and most important (3) to compare with terrestrial measurements to select the most possible results.

Example 1 – Observations in A.M. – Results are not much different ($\Delta 2D=14\text{mm}$, $\Delta 3D=30\text{mm}$)

```

* * * * *
*
* Final Result - Nail4
*
* WGS84 (ITRF96) Geodetic Coordinates
* -----
* Latitude   = 22^ 31' 20.11138" N   Standard Error = 2.5mm
* Longitude  = 114^ 09' 20.38445" E   Standard Error = 2.8mm
* Ell Height = 15.3294m               Standard Error = 8.7mm
*
* Hong Kong 1980 Grid Coordinates (By Two Step Transformation)
* -----
* Northing  = 842507.304m
* Easting   = 834085.707m
* Height    = 18.617m (for reference only)
*
* The station 'Nail4' is
* - fixed by 6 independent GPS baselines      (at least 3)
* - connected to 3 SatRef GPS stations        (at least 2)
* - obtained from 2 observation sessions      (at least 2)
* - computed by following baselines (sessions)
*   ~ HKFN 12 (3.5km)
*   ~ HKKT 12 (12.5km)
*   ~ HKSS 12 (15.5km)
*
* Computation Accuracy      : 10mm + 3ppm
* Maximum Standard Error    : 30mm
* Minimum Session Duration  : 15 minutes
* Minimum Session Lapse    : 30 minutes
* Elevation Mask            : 15 degrees
* Reject GDOP Exceed       : 5
* Frequency Strategy        : L3 Preference
*
*
* Observation Session
* -----
* Sess   Start(HKT)      End(HKT)      Duration      Lapse
* -----
* 1      2013-06-06 10:01 2013-06-06 10:36 00:34(Pass)
* 2      2013-06-06 11:09 2013-06-06 11:40 00:30(Pass) 00:33(Pass)
* -----
*
* Checking Origin - Misclosure Summary
* -----
* Session  Origin      Length  Latitude  Longitude  Allowable
* -----
* 1        HKFN - HKKT   9.2km   4.8mm    7.9mm     58.7mm  Pass
*          HKFN - HKSS  15.2    2.3      11.9     60.0    Pass
*          HKKT - HKSS  20.9    2.4      4.0      60.0    Pass

```

```

* * * * *
*
* Final Result - Nail4
*
* WGS84 (ITRF96) Geodetic Coordinates
* -----
* Latitude   = 22^ 31' 20.11130" N   Standard Error = 2.8mm
* Longitude  = 114^ 09' 20.38495" E   Standard Error = 3.2mm
* Ell Height = 15.3020m               Standard Error = 9.8mm
*
* Hong Kong 1980 Grid Coordinates (By Two Step Transformation)
* -----
* Northing  = 842507.302m
* Easting   = 834085.721m
* Height    = 18.590m (for reference only)
*
* The station 'Nail4' is
* - fixed by 6 independent GPS baselines      (at least 3)
* - connected to 3 SatRef GPS stations        (at least 2)
* - obtained from 2 observation sessions      (at least 2)
* - computed by following baselines (sessions)
*   ~ HKFN 12 (3.5km)
*   ~ HKKT 12 (12.5km)
*   ~ HKSS 12 (15.5km)
*
* Computation Accuracy      : 10mm + 3ppm
* Maximum Standard Error    : 30mm
* Minimum Session Duration  : 15 minutes
* Minimum Session Lapse    : 30 minutes
* Elevation Mask            : 15 degrees
* Reject GDOP Exceed       : 5
* Frequency Strategy        : Auto Preference
*
*
* Observation Session
* -----
* Sess   Start(HKT)      End(HKT)      Duration      Lapse
* -----
* 1      2013-06-06 10:01 2013-06-06 10:36 00:34(Pass)
* 2      2013-06-06 11:09 2013-06-06 11:40 00:30(Pass) 00:33(Pass)
* -----
*
* Checking Origin - Misclosure Summary
* -----
* Session  Origin      Length  Latitude  Longitude  Allowable
* -----
* 1        HKFN - HKKT   9.2km   10.7mm   0.5mm     58.7mm  Pass
*          HKFN - HKSS  15.2    2.3      11.9     60.0    Pass
*          HKKT - HKSS  20.9    2.4      4.0      60.0    Pass

```

2	HKFN - HKKT	9.2km	3.5mm	4.5mm	58.7mm	Pass
	HKFN - HKSS	15.2	6.2	19.1	60.0	Pass
	HKKT - HKSS	20.9	2.7	14.7	60.0	Pass

Baseline Ambiguity Status and Quality

No.	From	To	Sess	Dist	GDOP	3DQly	Fix	IonoAct	Frequency
1	HKFN	Nail4	1	3.5	4.4	1.8	Yes	Auto	Iono Free (L3)
2	HKKT	Nail4	1	12.5	4.4	1.9	Yes	Auto	Iono Free (L3)
3	HKSS	Nail4	1	15.5	4.4	1.9	Yes	Auto	Iono Free (L3)
4	HKFN	Nail4	2	3.5	4.3	2.0	Yes	Auto	Iono Free (L3)
5	HKKT	Nail4	2	12.5	4.3	1.9	Yes	Auto	Iono Free (L3)
6	HKSS	Nail4	2	15.5	4.3	1.9	Yes	Auto	Iono Free (L3)

Repeated Baseline Summary

Sess	GDOP	Delta Lat	Delta Long	Delta Ht	Remarks
HKFN - Nail4					
1	4.4	1'39.24104"	1'02.97848"	-25.8669	
2	4.3	1'39.24145"	1'02.97863"	-25.8840	
Spread:		12.2mm	4.5mm	2 Baselines	
Allowable:		41.3mm	41.3mm	L=3.544km	
HKKT - Nail4					
1	4.4	4'38.44946"	5'20.75005"	-19.2314	
2	4.3	4'38.44989"	5'20.75030"	-19.2567	
Spread:		12.9mm	7.5mm	2 Baselines	
Allowable:		84.9mm	84.9mm	L=12.547km	
HKSS - Nail4					
1	4.4	5'28.26669"	-6'49.07225"	-23.3803	
2	4.3	5'28.26720"	-6'49.07228"	-23.3772	
Spread:		15.4mm	1.0mm	2 Baselines	
Allowable:		84.9mm	84.9mm	L=15.450km	

2	HKFN - HKKT	9.2km	3.4mm	1.0mm	58.7mm	Pass
	HKFN - HKSS	15.2	6.2	19.1	60.0	Pass
	HKKT - HKSS	20.9	2.7	14.7	60.0	Pass

Baseline Ambiguity Status and Quality

No.	From	To	Sess	Dist	GDOP	3DQly	Fix	IonoAct	Frequency
1	HKFN	Nail4	1	3.5	4.4	0.7	Yes	Auto	L1 + L2
2	HKKT	Nail4	1	12.5	4.4	1.1	Yes	Auto	L1 + L2
3	HKSS	Nail4	1	15.5	4.4	1.9	Yes	Auto	Iono Free (L3)
4	HKFN	Nail4	2	3.5	4.2	0.9	Yes	Auto	L1 + L2
5	HKKT	Nail4	2	12.5	4.2	1.4	Yes	Auto	L1 + L2
6	HKSS	Nail4	2	15.5	4.2	1.9	Yes	Auto	Iono Free (L3)

Repeated Baseline Summary

Sess	GDOP	Delta Lat	Delta Long	Delta Ht	Remarks
HKFN - Nail4					
1	4.4	1'39.24102"	1'02.97894"	-25.9037	
2	4.2	1'39.24133"	1'02.97886"	-25.8996	
Spread:		9.1mm	2.5mm	2 Baselines	
Allowable:		41.3mm	41.3mm	L=3.544km	
HKKT - Nail4					
1	4.4	4'38.44965"	5'20.75104"	-19.2669	
2	4.2	4'38.44982"	5'20.75063"	-19.2840	
Spread:		5.3mm	12.5mm	2 Baselines	
Allowable:		84.9mm	84.9mm	L=12.547km	
HKSS - Nail4					
1	4.4	5'28.26669"	-6'49.07225"	-23.3803	
2	4.2	5'28.26720"	-6'49.07228"	-23.3772	
Spread:		15.4mm	1.0mm	2 Baselines	
Allowable:		84.9mm	84.9mm	L=15.450km	

Least Squares Network Adjustment - Residuals Report

Baseline	Session	Input (m)	Std Err (mm)	--Residual--		Allowable ENH	
				XYZ	ENH		
1 HKSS - Nail4	1	DX	12257.5810	4.3	6.5	-7.8	60.0 Pass
		DY	1255.5666	7.6	4.5	-5.4	60.0 Pass
		DZ	9321.5960	3.6	-5.3	-0.7	
		DV	15450.4657				
2 HKSS - Nail4	2	DX	12257.5832	4.3	8.7	-8.8	60.0 Pass
		DY	1255.5641	7.6	2.0	10.3	60.0 Pass
		DZ	9321.6117	3.6	10.4	2.4	
		DV	15450.4767				
3 HKKT - Nail4	1	DX	-7023.6236	4.3	1.5	-1.1	60.0 Pass
		DY	-6751.5005	7.6	-0.8	-5.5	60.0 Pass
		DZ	7906.8019	3.6	-6.5	-3.7	
		DV	12547.1735				
4 HKKT - Nail4	2	DX	-7023.6185	4.3	6.6	6.1	60.0 Pass
		DY	-6751.5294	7.6	-29.7	7.7	60.0 Pass
		DZ	7906.8044	3.6	-4.0	-29.1	
		DV	12547.1878				
5 HKFN - Nail4	1	DX	-1154.6314	4.3	-9.6	3.5	29.2 Pass
		DY	-1824.5111	7.6	12.9	-8.0	29.2 Pass
		DZ	2810.2529	3.6	-2.1	13.7	
		DV	3543.9436				
6 HKFN - Nail4	2	DX	-1154.6270	4.3	-5.1	7.8	29.2 Pass
		DY	-1824.5317	7.6	-7.7	4.6	29.2 Pass
		DZ	2810.2580	3.6	2.9	-3.4	
		DV	3543.9567				

Least Squares Network Adjustment - Residuals Report

Baseline	Session	Input (m)	Std Err (mm)	--Residual--		Allowable ENH	
				XYZ	ENH		
1 HKSS - Nail4	1	DX	12257.5810	5.1	9.7	-22.3	60.0 Pass
		DY	1255.5666	8.5	32.7	-3.0	60.0 Pass
		DZ	9321.5960	4.1	7.4	26.8	
		DV	15450.4657				
2 HKSS - Nail4	2	DX	12257.5832	5.1	11.9	-23.2	60.0 Pass
		DY	1255.5641	8.5	30.2	12.8	60.0 Pass
		DZ	9321.6117	4.1	23.2	29.8	
		DV	15450.4767				
3 HKKT - Nail4	1	DX	-7023.6352	5.1	-6.9	12.9	60.0 Pass
		DY	-6751.5441	8.5	-16.2	2.6	60.0 Pass
		DZ	7906.7935	4.1	-2.2	-11.9	
		DV	12547.1982				
4 HKKT - Nail4	2	DX	-7023.6170	5.1	11.3	0.9	60.0 Pass
		DY	-6751.5555	8.5	-27.6	8.0	60.0 Pass
		DZ	7906.7920	4.1	-3.7	-28.9	
		DV	12547.1932				
5 HKFN - Nail4	1	DX	-1154.6298	5.1	-4.8	2.3	29.2 Pass
		DY	-1824.5473	8.5	4.9	-6.2	29.2 Pass
		DZ	2810.2383	4.1	-4.1	4.4	
		DV	3543.9500				
6 HKFN - Nail4	2	DX	-1154.6276	5.1	-2.6	-0.1	29.2 Pass
		DY	-1824.5462	8.5	6.0	3.1	29.2 Pass
		DZ	2810.2484	4.1	6.1	8.4	
		DV	3543.9568				

Independent Checking of GPS Measurements by Terrestrial Measurements

Station Name	GPS Survey Results		Remark
	Northing	Easting	
Nail 1	842592.400	833766.166	Determined by SatRef GNSS Automatic Computation (L3 Preference)
Nail 2	842562.448	833913.165	
Nail 3	842552.823	834017.238	
Nail 4	842507.304	834085.707	

GPS Survey Results		Remark
Northing (m)	Easting (m)	
842592.396	833766.171	Determined by SatRef GNSS Automatic Computation (Auto Preference)
842562.445	833913.171	
842552.821	834017.252	
842507.302	834085.721	

	Computed Distance (1)	Measured Distance by Terrestrial Method (2)	Diff. (1)-(2)	Allowable Diff. (15+0.1D)
Nail 1 - Nail 2	150.019	150.017	0.002	0.030
Nail 2 - Nail 3	104.517	104.514	0.003	0.025
Nail 3 - Nail 4	82.219	82.216	0.003	0.023

	Computed Distance (1)	Measured Distance by Terrestrial Method (2)	Diff. (1)-(2)	Allowable Diff. (15+0.1D)
Nail 1 - Nail 2	150.020	150.017	0.003	0.030
Nail 2 - Nail 3	104.525	104.514	0.011	0.025
Nail 3 - Nail 4	82.219	82.216	0.003	0.023

Angle	Computed Angle (3)	Measured Angle by Terrestrial Method (2)	Diff. (3)-(4)	Allowable Diff.
@Nail 2 - Nail 1 - Nail 3	173-46-02	173-46-16	-14"	60"
@Nail 3 - Nail 2 - Nail 4	151-40-03	151-40-05	-2"	60"

Angle	Computed Angle (3)	Measured Angle by Terrestrial Method (2)	Diff. (3)-(4)	Allowable Diff.
@Nail 2 - Nail 1 - Nail 3	173-45-59	173-46-16	-17"	60"
@Nail 3 - Nail 2 - Nail 4	151-39-59	151-40-05	-6"	60"

Adopt L3 Preference Computation Results

Click below links to see individual computation reports				
L3 Preference:	Nail 1	Nail 2	Nail 3	Nail 4
Auto Preference:	Nail 1	Nail 2	Nail 3	Nail 4

Example 2 – Observations at noon – Results are not much different ($\Delta 2D=14\text{mm}$, $\Delta 3D=34\text{mm}$)

```

* * * * *
*
* Final Result - KL2
*
* WGS84 (ITRF96) Geodetic Coordinates
* -----
* Latitude   = 22^ 29' 35.71634" N   Standard Error = 10.0mm
* Longitude  = 114^ 05' 02.01604" E   Standard Error = 9.8mm
* Ell Height = 7.4012m                 Standard Error = 27.4mm
*
* Hong Kong 1980 Grid Coordinates (By Two Step Transformation)
* -----
* Northing  = 839298.891m
* Easting   = 826700.125m
* Height    = 10.932m (for reference only)
*
* The station 'KL2' is
* - fixed by 5 independent GPS baselines      (at least 3)
* - connected to 3 SatRef GPS stations        (at least 2)
* - obtained from 2 observation sessions      (at least 2)
* - computed by following baselines (sessions)
*   ~ HKFN 12 (5.6km)
*   ~ HKKT 12 (5.6km)
*   ~ HKLT -2 (12.2km)
*
* Computation Accuracy : 10mm + 3ppm
* Maximum Standard Error : 30mm
* Minimum Session Duration : 15 minutes
* Minimum Session Lapse : 30 minutes
* Elevation Mask : 15 degrees
* Reject GDOP Exceed : 5
* Frequency Strategy : L3 Preference

```

Click links to get [HTML Result](#) and [Full Report](#)

Observation Session

Sess	Start(HKT)	End(HKT)	Duration	Lapse
1	2012-05-03 11:41	2012-05-03 12:10	00:28(Pass)	
2	2012-05-03 12:40	2012-05-03 13:08	00:28(Pass)	00:30(Pass)

```

* * * * *
*
* Final Result - KL2
*
* WGS84 (ITRF96) Geodetic Coordinates
* -----
* Latitude   = 22^ 29' 35.71624" N   Standard Error = 14.1mm
* Longitude  = 114^ 05' 02.01649" E   Standard Error = 13.3mm
* Ell Height = 7.3706m                 Standard Error = 37.5mm
*
* Hong Kong 1980 Grid Coordinates (By Two Step Transformation)
* -----
* Northing  = 839298.887m
* Easting   = 826700.138m
* Height    = 10.901m (for reference only)
*
* The station 'KL2' is
* - fixed by 4 independent GPS baselines      (at least 3)
* - connected to 3 SatRef GPS stations        (at least 2)
* - obtained from 2 observation sessions      (at least 2)
* - computed by following baselines (sessions)
*   ~ HKFN 12 (5.6km)
*   ~ HKKT 1- (5.6km)
*   ~ HKLT -2 (12.2km)
*
* Computation Accuracy : 10mm + 3ppm
* Maximum Standard Error : 30mm
* Minimum Session Duration : 15 minutes
* Minimum Session Lapse : 30 minutes
* Elevation Mask : 15 degrees
* Reject GDOP Exceed : 5
* Frequency Strategy : Auto Preference

```

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Observation Session

Sess	Start(HKT)	End(HKT)	Duration	Lapse
1	2012-05-03 11:41	2012-05-03 12:10	00:28(Pass)	
2	2012-05-03 12:40	2012-05-03 13:08	00:28(Pass)	00:30(Pass)

Checking Origin - Misclosure Summary

Session	Origin	Length	Latitude	Longitude	Allowable	
1	HKFN - HKKT	9.2km	3.3mm	9.6mm	58.7mm	Pass
	HKFN - HKLT	16.9	6.9	9.6	60.0	Pass
	HKKT - HKLT	7.8	13.2	18.9	50.8	Pass
2	HKFN - HKKT	9.2km	4.8mm	17.6mm	58.7mm	Pass
	HKFN - HKLT	16.9	10.2	15.3	60.0	Pass
	HKKT - HKLT	7.8	2.5	8.0	50.8	Pass

Baseline Ambiguity Status and Quality

No.	From	To	Sess	Dist	GDOP	3DQly	Fix	IonoAct	Frequency
1	HKFN	KL2	1	5.6	3.9	2.0	Yes	Auto	Iono Free (L3)
2	HKKT	KL2	1	5.6	3.9	3.2	Yes	Auto	Iono Free (L3)
3	HKLT	KL2	1	12.2	3.9	37.4	No	Medium	Iono Free (L3)
4	HKFN	KL2	2	5.6	4.0	1.7	Yes	Auto	Iono Free (L3)
5	HKKT	KL2	2	5.6	4.0	3.1	Yes	Auto	Iono Free (L3)
6	HKLT	KL2	2	12.2	4.0	2.9	Yes	Auto	Iono Free (L3)

Repeated Baseline Summary

Sess	GDOP	Delta Lat	Delta Long	Delta Ht	Remarks
HKFN - KL2					
1	3.9	-0'05.15386"	-3'15.38960"	-33.8426	
2	4.0	-0'05.15412"	-3'15.38987"	-33.8363	
Spread:		7.9mm	8.0mm	2 Baselines	
Allowable:		55.2mm	55.2mm	L=5.587km	
HKKT - KL2					
1	3.9	2'54.05439"	1'02.38176"	-27.1934	
2	4.0	2'54.05448"	1'02.38152"	-27.1481	
Spread:		2.9mm	7.2mm	2 Baselines	
Allowable:		55.6mm	55.6mm	L=5.643km	
HKLT - KL2					
2	4.0	4'30.43518"	5'14.17048"	-118.3870	???

Checking Origin - Misclosure Summary

Session	Origin	Length	Latitude	Longitude	Allowable	
1	HKFN - HKKT	9.2km	21.0mm	37.7mm	58.7mm	Pass
	HKFN - HKLT	16.9	6.9	9.6	60.0	Pass
	HKKT - HKLT	7.8	23.0	5.6	50.8	Pass
2	HKFN - HKKT	9.2km	33.0mm	16.3mm	58.7mm	Pass
	HKFN - HKLT	16.9	10.2	15.3	60.0	Pass
	HKKT - HKLT	7.8	20.7	14.9	50.8	Pass

Baseline Ambiguity Status and Quality

No.	From	To	Sess	Dist	GDOP	3DQly	Fix	IonoAct	Frequency
1	HKFN	KL2	1	5.6	3.9	1.4	Yes	Auto	L1 + L2
2	HKKT	KL2	1	5.6	3.9	2.0	Yes	Auto	L1 + L2
3	HKLT	KL2	1	12.2	3.9	37.4	No	Medium	Iono Free (L3)
4	HKFN	KL2	2	5.6	4.0	1.5	Yes	Auto	L1 + L2
5	HKKT	KL2	2	5.6	4.0	3.1	Yes	Auto	L1 + L2
6	HKLT	KL2	2	12.2	4.0	2.5	Yes	Auto	L1 + L2

Repeated Baseline Summary

Sess	GDOP	Delta Lat	Delta Long	Delta Ht	Remarks
HKFN - KL2					
1	3.9	-0'05.15344"	-3'15.38894"	-33.8539	
2	4.0	-0'05.15419"	-3'15.38912"	-33.8629	
Spread:		22.5mm	5.4mm	2 Baselines	
Allowable:		55.2mm	55.2mm	L=5.587km	
HKKT - KL2					
1	3.9	2'54.05372"	1'02.38135"	-27.2324	
2	4.0	2'54.05292"	1'02.38181"	-27.2709	
Spread:		24.0mm	13.8mm	2 Baselines	
Allowable:		55.6mm	55.6mm	L=5.643km	
HKLT - KL2					
2	4.0	4'30.43509"	5'14.17032"	-118.3775	???

Least Squares Network Adjustment - Residuals Report

Baseline	Session	Input (m)	Std Err (mm)	--Residual-- XYZ	ENH	Allowable ENH	
1 HKLT - KL2	2 DX	-6864.4886	13.6	-15.5	-35.3	60.0 Pass	
		DY	-6661.1323	23.8	121.5	48.2	60.0 Pass
		DZ	7642.7239	13.9	100.6	146.8	
		DV	12243.4927				
2 HKKT - KL2	1 DX	-783.3067	13.6	11.2	2.0	39.3 Pass	
		DY	-2618.6670	23.8	-30.2	-6.5	39.3 Pass
		DZ	4937.1282	13.9	-20.3	-37.5	
		DV	5643.2456				
3 HKKT - KL2	2 DX	-783.3171	13.6	0.9	-4.8	39.3 Pass	
		DY	-2618.6271	23.8	9.7	-3.5	39.3 Pass
		DZ	4937.1482	13.9	-0.3	7.8	
		DV	5643.2460				
4 HKFN - KL2	1 DX	5085.6861	13.6	0.7	12.6	39.0 Pass	
		DY	2308.3066	23.8	-32.3	-3.7	39.0 Pass
		DZ	-159.4211	13.9	-16.3	-33.7	
		DV	5587.2978				
5 HKFN - KL2	2 DX	5085.6894	13.6	4.1	4.9	39.0 Pass	
		DY	2308.3179	23.8	-21.0	-11.7	39.0 Pass
		DZ	-159.4262	13.9	-21.3	-27.4	
		DV	5587.3057				

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Least Squares Network Adjustment - Residuals Report (Final)

Baseline	Session	Input (m)	Std Err (mm)	--Residual-- XYZ	ENH	Allowable ENH	
1 HKLT - KL2	2 DX	-6864.4883	18.0	-14.8	-52.5	60.0 Pass	
		DY	-6661.1214	32.9	162.3	48.5	60.0 Pass
		DZ	7642.7248	19.3	116.2	186.9	
		DV	12243.4873				
2 HKKT - KL2	1 DX	-783.2845	18.0	33.9	-22.3	39.3 Pass	
		DY	-2618.6880	32.9	-21.3	-23.9	39.3 Pass
		DZ	4937.0942	19.3	-39.6	-45.9	
		DV	5643.2225				
3 HKFN - KL2	1 DX	5085.6751	18.0	-9.8	18.8	39.0 Pass	
		DY	2308.2848	32.9	-24.2	12.5	39.0 Pass
		DZ	-159.4134	19.3	6.0	-14.4	
		DV	5587.2787				
4 HKFN - KL2	2 DX	5085.6796	18.0	-5.3	13.7	39.0 Pass	
		DY	2308.2874	32.9	-21.7	-10.6	39.0 Pass
		DZ	-159.4382	19.3	-18.7	-23.4	
		DV	5587.2845				

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Example 3 – Observations in P.M. – Results are different ($\Delta 2D=30mm$, $\Delta 3D=55mm$)

<pre> * * * * * * * Final Result - Nail2 * * WGS84 (ITRF96) Geodetic Coordinates * ----- * Latitude = 22^ 13' 10.22718" N Standard Error = 3.5mm * Longitude = 114^ 12' 47.12550" E Standard Error = 4.6mm * Ell Height = 8.9522m Standard Error = 11.8mm * * Hong Kong 1980 Grid Coordinates (By Two Step Transformation) * ----- * Northing = 808982.946m * Easting = 840001.972m * Height = 11.254m (for reference only) * * The station 'Nail2' is * - fixed by 3 independent GPS baselines (at least 3) * - connected to 2 SatRef GPS stations (at least 2) * - obtained from 2 observation sessions (at least 2) * - computed by following baselines (sessions) * ~ HKOH 12 (3.5km) * ~ HKPC -2 (19.5km) * ~ HKSC -- (13.6km) * * Computation Accuracy : 10mm + 3ppm * Maximum Standard Error : 30mm * Minimum Session Duration : 15 minutes * Minimum Session Lapse : 30 minutes * Elevation Mask : 15 degrees * Reject GDOP Exceed : 5 * Frequency Strategy : L3 Preference * * This automatic computation result is for reference purpose * only. Different survey purposes have different survey * specifications and requirements. Lands Department gives no * guarantee regarding the correctness and completeness of this * automatic computation and shall not be liable for any loss * and damages arising from or related to the use of this * automatic computation result. Please verify this automatic * computation result before use. * * * 1.22.000734 * * * * * 2013-06-24 15:28:13 (HKT) * * </pre>	<pre> * * * * * * * Final Result - Nail2 * * WGS84 (ITRF96) Geodetic Coordinates * ----- * Latitude = 22^ 13' 10.22802" N Standard Error = 9.1mm * Longitude = 114^ 12' 47.12597" E Standard Error = 10.5mm * Ell Height = 8.9983m Standard Error = 29.9mm * * Hong Kong 1980 Grid Coordinates (By Two Step Transformation) * ----- * Northing = 808982.972m * Easting = 840001.986m * Height = 11.300m (for reference only) * * The station 'Nail2' is * - fixed by 3 independent GPS baselines (at least 3) * - connected to 2 SatRef GPS stations (at least 2) * - obtained from 2 observation sessions (at least 2) * - computed by following baselines (sessions) * ~ HKOH 12 (3.5km) * ~ HKPC -2 (19.5km) * ~ HKSC -- (13.6km) * * Computation Accuracy : 10mm + 3ppm * Maximum Standard Error : 30mm * Minimum Session Duration : 15 minutes * Minimum Session Lapse : 30 minutes * Elevation Mask : 15 degrees * Reject GDOP Exceed : 5 * Frequency Strategy : Auto Preference * * This automatic computation result is for reference purpose * only. Different survey purposes have different survey * specifications and requirements. Lands Department gives no * guarantee regarding the correctness and completeness of this * automatic computation and shall not be liable for any loss * and damages arising from or related to the use of this * automatic computation result. Please verify this automatic * computation result before use. * * * 1.22.000734 * * * * * 2013-06-24 15:31:15 (HKT) * * </pre>
<p>Remarks: Click below links to get HTML result and full report.</p> <p>Result.htm FullReport.zip</p>	<p>Remarks: Click below links to get HTML result and full report.</p> <p>Result.htm FullReport.zip</p>

Observation Session

Sess	Start(HKT)	End(HKT)	Duration	Lapse
1	2013-05-31 13:09	2013-05-31 13:28	00:19(Pass)	
2	2013-05-31 14:27	2013-05-31 14:45	00:18(Pass)	00:59(Pass)

Checking Origin - Misclosure Summary

Session	Origin	Length	Latitude	Longitude	Allowable	
1	HKOH - HKPC	20.1km	2.5mm	8.8mm	60.0mm	Pass
	HKOH - HKSC	12.2	2.4	6.4	60.0	Pass
	HKSC - HKPC	11.4	0.0	2.3	60.0	Pass
2	HKOH - HKPC	20.1km	6.1mm	0.8mm	60.0mm	Pass
	HKOH - HKSC	12.2	1.2	9.8	60.0	Pass
	HKSC - HKPC	11.4	4.9	9.1	60.0	Pass

Baseline Ambiguity Status and Quality

No.	From	To	Sess	Dist	GDOP	3DQly	Fix	IonoAct	Frequency
1	HKOH	Nail2	1	3.5	3.2	4.8	Yes	Auto	Iono Free (L3)
2	HKPC	Nail2	1	19.5	3.2	56.7	No	Medium	Iono Free (L3)
3	HKSC	Nail2	1	13.6	3.2	57.9	No	Medium	Iono Free (L3)
4	HKOH	Nail2	2	3.5	2.0	2.6	Yes	Auto	Iono Free (L3)
5	HKPC	Nail2	2	19.5	2.0	2.9	Yes	Auto	Iono Free (L3)
6	HKSC	Nail2	2	13.6	2.0	30.4	No	Medium	Iono Free (L3)

Observation Session

Sess	Start(HKT)	End(HKT)	Duration	Lapse
1	2013-05-31 13:09	2013-05-31 13:28	00:19(Pass)	
2	2013-05-31 14:27	2013-05-31 14:45	00:18(Pass)	00:59(Pass)

Checking Origin - Misclosure Summary

Session	Origin	Length	Latitude	Longitude	Allowable	
1	HKOH - HKPC	20.1km	2.5mm	8.8mm	60.0mm	Pass
	HKOH - HKSC	12.2	54.5	38.7	60.0	Pass
	HKSC - HKPC	11.4	33.3	15.4	60.0	Pass
2	HKOH - HKPC	20.1km	6.1mm	0.8mm	60.0mm	Pass
	HKOH - HKSC	12.2	60.2	11.1	60.0	Fail
	HKSC - HKPC	11.4	86.5	39.0	60.0	Fail

Fail: HKSC

Baseline Ambiguity Status and Quality

No.	From	To	Sess	Dist	GDOP	3DQly	Fix	IonoAct	Frequency
1	HKOH	Nail2	1	3.5	3.2	2.2	Yes	Auto	L1 + L2
2	HKPC	Nail2	1	19.5	3.2	56.7	No	Medium	Iono Free (L3)
3	HKSC	Nail2	1	13.6	3.2	57.9	No	Medium	Iono Free (L3)
4	HKOH	Nail2	2	3.5	2.0	2.0	Yes	Auto	L1 + L2
5	HKPC	Nail2	2	19.5	2.0	2.9	Yes	Auto	Iono Free (L3)
6	HKSC	Nail2	2	13.6	2.0	30.4	No	Medium	Iono Free (L3)

Repeated Baseline Summary

Sess GDOP Delta Lat Delta Long Delta Ht Remarks

HKOH - Nail2

1 3.3 -1'41.44630" -0'55.66279" -157.4885
 2 2.1 -1'41.44659" -0'55.66236" -157.4458

Spread: 8.9mm 12.8mm 2 Baselines
 Allowable: 41.1mm 41.1mm L=3.508km

HKPC - Nail2

2 2.1 -3'55.58963" 10'30.89990" -9.1965 ???

Least Squares Network Adjustment - Residuals Report

Baseline	Session	Input (m)	Std Err (mm)	--Residual--		Allowable ENH
				XYZ	ENH	
1 HKPC - Nail2	2	DX -17604.8139	5.5	6.6	2.9	60.0 Pass
		DY -4886.9220	10.5	-21.8	-3.2	60.0 Pass
		DZ -6710.3987	5.6	-12.7	-25.8	
		DV 19463.8364				
2 HKOH - Nail2	1	DX 1029.1078	5.5	18.1	-9.2	29.0 Pass
		DY 1597.8002	10.5	-17.8	9.4	29.0 Pass
		DZ -2948.0404	5.6	0.5	-21.7	
		DV 3507.5591				
3 HKOH - Nail2	2	DX 1029.0790	5.5	-10.6	2.9	29.0 Pass
		DY 1597.8345	10.5	16.4	0.3	29.0 Pass
		DZ -2948.0327	5.6	8.2	21.0	
		DV 3507.5598				

Remarks: Click below links to get HTML result and full report.

[Result.htm](#) [FullReport.zip](#)

Repeated Baseline Summary

Sess GDOP Delta Lat Delta Long Delta Ht Remarks

HKOH - Nail2

1 3.2 -1'41.44577" -0'55.66214" -157.4005
 2 2.0 -1'41.44524" -0'55.66145" -157.4037

Spread: 16.0mm 20.8mm 2 Baselines
 Allowable: 41.1mm 41.1mm L=3.508km

HKPC - Nail2

2 2.0 -3'55.58963" 10'30.89990" -9.1965 ???

Least Squares Network Adjustment - Residuals Report

Baseline	Session	Input (m)	Std Err (mm)	--Residual--		Allowable ENH
				XYZ	ENH	
1 HKPC - Nail2	2	DX -17604.8139	14.5	32.3	-10.6	60.0 Pass
		DY -4886.9220	26.1	-46.4	-29.0	60.0 Pass
		DZ -6710.3987	14.2	-54.1	-71.9	
		DV 19463.8364				
2 HKOH - Nail2	1	DX 1029.0600	14.5	-4.0	-4.1	29.0 Pass
		DY 1597.8614	26.1	18.8	-0.4	29.0 Pass
		DZ -2947.9922	14.2	7.3	20.1	
		DV 3507.5324				
3 HKOH - Nail2	2	DX 1029.0457	14.5	-18.3	15.7	29.0 Pass
		DY 1597.8449	26.1	2.3	16.1	29.0 Pass
		DZ -2947.9782	14.2	21.3	16.9	
		DV 3507.5089				

Remarks: Click below links to get HTML result and full report.

[Result.htm](#) [FullReport.zip](#)

Example 4 – More than one hour observations in both A.M and P.M. – Results are nearly the same ($\Delta 2D=4mm$, $\Delta 3D=8mm$)

```

* * * * *
*
* Final Result - AA02a
*
* WGS84 (ITRF96) Geodetic Coordinates
* -----
* Latitude   = 22^ 19' 16.26736" N   Standard Error = 3.4mm
* Longitude  = 114^ 14' 46.54946" E   Standard Error = 3.6mm
* Ell Height  = 132.3912m             Standard Error = 9.7mm
*
* Hong Kong 1980 Grid Coordinates (By Two Step Transformation)
* -----
* Northing   = 820243.336m
* Easting    = 843417.061m
* Height     = 134.796m (for reference only)
*
* The station 'AA02a' is
* - fixed by 4 independent GPS baselines      (at least 3)
* - connected to 3 SatRef GPS stations        (at least 2)
* - obtained from 2 observation sessions      (at least 2)
* - computed by following baselines (sessions)
*   ~ HKOH 1- (8.3km)
*   ~ HKSC 12 (10.8km)
*   ~ HKST 1- (10.4km)
*
* Computation Accuracy      : 10mm + 3ppm
* Maximum Standard Error    : 30mm
* Minimum Session Duration  : 15 minutes
* Minimum Session Lapse    : 30 minutes
* Elevation Mask            : 15 degrees
* Reject GDOP Exceed       : 5
* Frequency Strategy        : L3 Preference

```

Click links to get [HTML Result](#) and [Full Report](#)

Observation Session

Sess	Start(HKT)	End(HKT)	Duration	Lapse
1	2013-04-15 10:21	2013-04-15 12:10	01:49(Pass)	
2	2013-04-15 14:14	2013-04-15 15:25	01:11(Pass)	02:04(Pass)

```

* * * * *
*
* Final Result - AA02a
*
* WGS84 (ITRF96) Geodetic Coordinates
* -----
* Latitude   = 22^ 19' 16.26734" N   Standard Error = 4.4mm
* Longitude  = 114^ 14' 46.54960" E   Standard Error = 4.5mm
* Ell Height  = 132.3799m             Standard Error = 12.5mm
*
* Hong Kong 1980 Grid Coordinates (By Two Step Transformation)
* -----
* Northing   = 820243.335m
* Easting    = 843417.065m
* Height     = 134.784m (for reference only)
*
* The station 'AA02a' is
* - fixed by 5 independent GPS baselines      (at least 3)
* - connected to 3 SatRef GPS stations        (at least 2)
* - obtained from 2 observation sessions      (at least 2)
* - computed by following baselines (sessions)
*   ~ HKOH 1- (8.3km)
*   ~ HKSC 12 (10.8km)
*   ~ HKST 12 (10.4km)
*
* Computation Accuracy      : 10mm + 3ppm
* Maximum Standard Error    : 30mm
* Minimum Session Duration  : 15 minutes
* Minimum Session Lapse    : 30 minutes
* Elevation Mask            : 15 degrees
* Reject GDOP Exceed       : 5
* Frequency Strategy        : Auto Preference

```

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Observation Session

Sess	Start(HKT)	End(HKT)	Duration	Lapse
1	2013-04-15 10:21	2013-04-15 12:10	01:49(Pass)	
2	2013-04-15 14:14	2013-04-15 15:25	01:11(Pass)	02:04(Pass)

Checking Origin - Misclosure Summary

Session	Origin	Length	Latitude	Longitude	Allowable	
1	HKOH - HKSC	12.2km	3.5mm	8.1mm	60.0mm	Pass
	HKOH - HKST	17.0	13.2	8.1	60.0	Pass
	HKST - HKSC	9.2	9.7	0.1	58.9	Pass
2	HKOH - HKSC	12.2km	1.2mm	7.2mm	60.0mm	Pass
	HKOH - HKST	17.0	10.5	4.2	60.0	Pass
	HKST - HKSC	9.2	48.8	5.8	58.9	Pass

Baseline Ambiguity Status and Quality

No.	From	To	Sess	Dist	GDOP	3DQly	Fix	IonoAct	Frequency
1	HKOH	AA02a	1	8.3	4.8	1.5	Yes	Auto	Iono Free (L3)
2	HKSC	AA02a	1	10.8	4.8	1.7	Yes	Auto	Iono Free (L3)
3	HKST	AA02a	1	10.4	4.8	1.9	Yes	Auto	Iono Free (L3)
4	HKOH	AA02a	2	8.3	4.4	19.0	No	Medium	Iono Free (L3)
5	HKSC	AA02a	2	10.8	4.4	2.8	Yes	Auto	Iono Free (L3)
6	HKST	AA02a	2	10.4	4.4	7.0	Yes	Auto	Iono Free (L3)

Repeated Baseline Summary

Sess	GDOP	Delta Lat	Delta Long	Delta Ht	Remarks
HKOH - AA02a					
1	4.8	4'24.59377"	1'03.76178"	-34.0112	???
HKSC - AA02a					
1	4.8	-0'03.55222"	6'18.27295"	112.1608	
2	4.4	-0'03.55208"	6'18.27257"	112.1242	
Spread:		4.1mm	11.4mm	2 Baselines	
Allowable:		84.9mm	84.9mm	L=10.827km	
HKST - AA02a					
1	4.8	-4'26.70688"	3'43.27917"	-126.3344	
2	4.4	-4'26.70886"	3'43.27750"	-126.4565	
Spread:		59.4mm	50.0mm	2 Baselines	
Allowable:		84.9mm	84.9mm	L=10.399km	

Checking Origin - Misclosure Summary

Session	Origin	Length	Latitude	Longitude	Allowable	
1	HKOH - HKSC	12.2km	6.0mm	6.1mm	60.0mm	Pass
	HKOH - HKST	17.0	13.2	8.1	60.0	Pass
	HKST - HKSC	9.2	1.3	3.6	58.9	Pass
2	HKOH - HKSC	12.2km	43.3mm	7.3mm	60.0mm	Pass
	HKOH - HKST	17.0	10.5	4.2	60.0	Pass
	HKST - HKSC	9.2	66.4	4.8	58.9	Fail

Baseline Ambiguity Status and Quality

No.	From	To	Sess	Dist	GDOP	3DQly	Fix	IonoAct	Frequency
1	HKOH	AA02a	1	8.3	4.8	0.7	Yes	Auto	L1 + L2
2	HKSC	AA02a	1	10.8	4.8	0.6	Yes	Auto	L1 + L2
3	HKST	AA02a	1	10.4	4.8	0.8	Yes	Auto	L1 + L2
4	HKOH	AA02a	2	8.3	4.4	19.0	No	Medium	Iono Free (L3)
5	HKSC	AA02a	2	10.8	4.4	1.6	Yes	Auto	L1 + L2
6	HKST	AA02a	2	10.4	4.4	3.0	Yes	Auto	L1 + L2

Repeated Baseline Summary

Sess	GDOP	Delta Lat	Delta Long	Delta Ht	Remarks
HKOH - AA02a					
1	4.8	4'24.59343"	1'03.76182"	-34.0511	???
HKSC - AA02a					
1	4.8	-0'03.55203"	6'18.27319"	112.1555	
2	4.4	-0'03.55208"	6'18.27189"	112.1476	
Spread:		1.4mm	38.9mm	2 Baselines	
Allowable:		84.9mm	84.9mm	L=10.827km	
HKST - AA02a					
1	4.8	-4'26.70661"	3'43.27962"	-126.3240	
2	4.4	-4'26.70856"	3'43.27808"	-126.3786	
Spread:		58.3mm	46.1mm	2 Baselines	
Allowable:		84.9mm	84.9mm	L=10.399km	

Least Squares Network Adjustment - Residuals Report (Final)

Baseline	Session	Input (m)	Std Err (mm)	--Residual-- XYZ	ENH	Allowable ENH
2 HKOH - AA02a	1 DX	-384.4985	5.2	-13.0	8.4	53.9 Pass
	DY	-3592.3000	8.5	8.3	6.2	53.9 Pass
	DZ	7518.1847	4.4	12.0	16.5	
	DV	8341.1965				
3 HKSC - AA02a	1 DX	-9934.4834	5.2	2.0	-1.1	60.0 Pass
	DY	-4304.1831	8.5	-1.6	-2.4	60.0 Pass
	DZ	-58.4791	4.4	-3.5	-3.4	
	DV	10826.9743				
1 HKST - AA02a	1 DX	-7058.5148	5.2	1.6	-3.1	60.0 Pass
	DY	119.3041	8.5	4.0	-4.5	60.0 Pass
	DZ	-7635.3951	4.4	-3.6	1.4	
	DV	10398.8520				
4 HKSC - AA02a	2 DX	-9934.4589	5.2	26.4	-12.0	60.0 Pass
	DY	-4304.2110	8.5	-29.5	1.8	60.0 Pass
	DZ	-58.4891	4.4	-13.5	-40.0	
	DV	10826.9630				

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Least Squares Network Adjustment - Residuals Report

Baseline	Session	Input (m)	Std Err (mm)	--Residual-- XYZ	ENH	Allowable ENH
1 HKOH - AA02a	1 DX	-384.4860	6.5	-0.9	5.4	53.9 Pass
	DY	-3592.3304	11.0	-11.0	-3.9	53.9 Pass
	DZ	7518.1597	5.8	-8.2	-12.1	
	DV	8341.1865				
2 HKSC - AA02a	1 DX	-9934.4867	6.5	-1.8	1.6	60.0 Pass
	DY	-4304.1924	11.0	0.2	3.9	60.0 Pass
	DZ	-58.4759	5.8	4.6	2.6	
	DV	10826.9810				
4 HKST - AA02a	1 DX	-7058.5292	6.5	-13.2	5.6	60.0 Pass
	DY	119.3047	11.0	15.7	4.1	60.0 Pass
	DZ	-7635.3837	5.8	12.5	23.1	
	DV	10398.8534				
3 HKSC - AA02a	2 DX	-9934.4502	6.5	34.7	-35.5	60.0 Pass
	DY	-4304.1833	11.0	9.3	2.4	60.0 Pass
	DZ	-58.4802	5.8	0.3	-5.2	
	DV	10826.9439				
5 HKST - AA02a	2 DX	-7058.4777	6.5	38.3	-38.4	60.0 Pass
	DY	119.2974	11.0	8.5	-55.7	60.0 Pass
	DZ	-7635.4598	5.8	-63.5	-31.6	
	DV	10398.8742				

Click links to get [HTML Result](#) and [Full Report](#)

T.6 Tips – Consider Horizontal Components Only ?

The following computation meets all LBS GPS Spec requirements – Although the standard errors are not so good, the **discrepancies of horizontal components are within allowable**. However, the **discrepancies of the vertical components are very large, but they are not considered according to the LBS GPS Spec**.

```

*   WGS84 (ITRF96) Geodetic Coordinates                               *
*   -----                                                         *
*   Latitude   = 22^ 25' 09.08949" N   Standard Error = 23.4mm   *
*   Longitude  = 114^ 14' 08.25216" E   Standard Error = 22.6mm   *
*   Ell Height = 69.8438m               Standard Error = 64.6mm   *
*   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *
*   The station 'Naill' is                                           *
*   - fixed by 4 independent GPS baselines   (at least 3)   *
*   - connected to 3 SatRef GPS stations    (at least 2)   *
*   - obtained from 2 observation sessions  (at least 2)   *

```

Repeated Baseline Summary

```

-----
Sess  GDOP    Delta Lat    Delta Long    Delta Ht    Remarks
-----
HKFN - Naill
2     3.7    -4'31.77950"  5'50.84548"  28.4449    ???
-----

```

```

HKSS - Naill
1     3.6    -0'42.75398" -2'01.20472"  31.3304
2     3.7    -0'42.75439" -2'01.20455"  30.9155
-----
Spread:      12.3mm      5.1mm      0.4149m  2 Baselines
Allowable:   42.3mm      42.3mm
L=3.707km
-----

```

```

HKST - Naill
1     3.6    1'26.11648"  3'04.98198" -188.6729
2     3.7    1'26.11565"  3'04.98137" -189.0488
-----
Spread:      25.0mm      18.2mm      0.3759m  2 Baselines
Allowable:   57.6mm      57.6mm
L=5.920km
-----

```

Least Squares Network Adjustment - Residuals Report (Final)

Baseline	Session	Input (m)	Std Err (mm)	--Residual--		Allowable ENH	
				XYZ	ENH		
3 HKST - Naill	1	DX	-4339.9110	31.6	-74.7	0.3	40.8 Pass
		DY	-3249.7272	56.2	165.6	33.4	40.8 Pass
		DZ	2377.0819	32.8	111.0	210.3	
		DV	5919.9724				
1 HKFN - Naill	2	DX	-10469.7272	31.6	92.2	-17.0	60.0 Pass
		DY	-1172.8236	56.2	-164.1	33.9	60.0 Pass
		DZ	-7715.2126	32.8	-40.9	-188.8	
		DV	13058.1472				
2 HKSS - Naill	2	DX	2942.4707	31.6	93.7	-8.1	29.9 Pass
		DY	1907.2383	56.2	-188.3	19.5	29.9 Pass
		DZ	-1203.8912	32.8	-65.6	-219.3	
		DV	3707.4311				
4 HKST - Naill	2	DX	-4339.7566	31.6	79.8	-17.4	40.8 Pass
		DY	-3250.0281	56.2	-135.2	7.6	40.8 Pass
		DZ	2376.9148	32.8	-56.0	-165.6	
		DV	5919.9572				

The height residuals of the network adjustment fall into two groups: Session 1 is positive 210mm and Session 2 is about negative 190mm (mean). They are in the same magnitude but in opposite signs. Looking into the baseline details, the rover antenna height of session 2 – 2.149m was unreasonably high. The height hoop offset 0.360m might be applied twice.

```

*****
* Baseline HKFN - Nail1 Session 1 *
*****

Station Information
-----
Station:                Reference: HKFN           Rover: Nail1
Receiver type:          GRX1200+             SR530
Receiver s/n:           455689              34726
Antenna type:           LEIAR25.R4          LEIT  LEIAT502
Antenna Height:         1.7780m             1.7610m

*****
* Baseline HKFN - Nail1 Session 2 *
*****

Station Information
-----
Station:                Reference: HKFN           Rover: Nail1
Receiver type:          GRX1200+             SR530
Receiver s/n:           455689              34726
Antenna type:           LEIAR25.R4          LEIT  LEIAT502
Antenna Height:         1.7780m             2.1490m - 0.36 = 1.789m

```

Repeated Baseline Summary of Corrected Antenna Height of Session 2

```

Repeated Baseline Summary
-----
Sess  GDOP    Delta Lat    Delta Long    Delta Ht    Remarks
-----
HKFN - Nail1
2      3.7    -4'31.77950"  5'50.84548"  28.8049    ???
-----
HKSS - Nail1
1      3.6    -0'42.75398" -2'01.20472"  31.3303
2      3.7    -0'42.75439" -2'01.20455"  31.2755
-----
    Spread:      12.3mm        5.1mm        54.8mm    2 Baselines
    Allowable:    42.3mm        42.3mm
                                     L=3.707km
-----
HKST - Nail1
1      3.6     1'26.11648"  3'04.98198" -188.6728
2      3.7     1'26.11565"  3'04.98137" -188.6888
-----
    Spread:      25.0mm        18.2mm        16.0mm    2 Baselines
    Allowable:    57.6mm        57.6mm
                                     L=5.920km
-----


```



```

*****
* Wrong Antenna Height
* Final Result - Nail1
*
* WGS84 (ITRF96) Geodetic Coordinates
* -----
* Latitude   = 22^ 25' 09.08949" N   Standard Error = 23.4mm
* Longitude  = 114^ 14' 08.25216" E   Standard Error = 22.6mm
* Ell Height = 69.8438m                Standard Error = 64.6mm
*
* Hong Kong 1980 Grid Coordinates (By Two Step Transformation)
* -----
* Northing  = 831095.623m
* Easting   = 842316.792m
* Height    = 72.533m (for reference only)
*
* The station 'Nail1'
* - fixed by 4 independ
* - connected to 3 Sat
* - obtained from 2 ob
* - computed by follow
* ~ HKFN -2 (13.1km)
* ~ HKSS -2 (3.7km)
* ~ HKST 12 (5.9km)
*
*****
* Corrected
* Final Result - Nail1
*
* WGS84 (ITRF96) Geodetic Coordinates
* -----
* Latitude   = 22^ 25' 09.09013" N   Standard Error = 4.3mm
* Longitude  = 114^ 14' 08.25191" E   Standard Error = 4.0mm
* Ell Height = 70.0268m                Standard Error = 10.8mm
*
* Hong Kong 1980 Grid Coordinates (By Two Step Transformation)
* -----
* Northing  = 831095.642m
* Easting   = 842316.785m
* Height    = 72.716m (for reference only)
*
* The station 'Nail1' is
* - fixed by 5 independent GPS baselines (at least 3)
* - connected to 3 SatRef GPS stations (at least 2)
* - obtained from 2 observation sessions (at least 2)
* - computed by following baselines (sessions)
* ~ HKFN -2 (13.1km)
* ~ HKSS 12 (3.7km)
* ~ HKST 12 (5.9km)

```

 Although height information is not required in land boundary surveys, however GPS survey is 3D positioning, both horizontal and vertical components are interacted, you are advised to keep an eye on the vertical figures.

In order to identify antenna height mistake more easily, the antenna heights were reported in the top of the result.htm

New Station Name: Nail1

Computation Accuracy: 10mm + 3ppm

Upload files: 1. Nail1134.13o 94Kb Nail1 1.761m
 2. Nail1135.13o 95Kb Nail1 2.149m
 3. Nail1134.13n 8Kb
 4. Nail1135.13n 8Kb

By: SO Mo Kan, PSO/G
 Geodetic Survey Section
 SMO, Lands Department

Date: 2013-06-28