SINEX_BIAS—Solution (Software/technique) INdependent EXchange Format for GNSS BIASes Version 1.00

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0. Revision History

0.1. Major Update from V0.01 to V1.00:

- This major update includes generalizations, extensions, and a considerable number of added detailed definitions, descriptions, and examples.
- (A listing/summary will be added after the discussions at the IGS Workshop 2016 in Sydney.)

1. Foreword and Acknowledgment

In 2011, a preliminary bias data format, called *SINEX_BIAS V0.01*, was proposed by Tim Springer (ESA/ESOC) for handling of GNSS bias estimates as part of the TGVF (Time and Geodetic Validation Facility) and the OVF (Orbit Validation Facility) of Galileo [Springer, 2011]. This format proposal was made on the basis of the *SINEX_TRO Format for combination of TROpospheric estimates Version 0.01* [Gendt, 1997].

The *SINEX_BIAS Format Version 1.00* is the result of a substantial update made on the basis of the *SINEX_BIAS V0.01*. It includes generalizations, extensions, and a considerable number of added detailed definitions, descriptions, and examples. The SINEX_BIAS format description document was completely rewritten. The original bias format concept—using the SINEX formalism—as formed by Tim Springer is acknowledged.

2. The Philosophy and General Features

2.1. Bias Data Format

In the face of a steadily growing variety of GNSS signals and observables, an adequate data format for GNSS bias products became indispensable.

The files should have a simple, but flexible structure, so that the IGS Analysis Centers (ACs) can straightforward reformat their internal bias estimates as well as users of IGS products can easily read and handle the bias products.

The proposed format is based on the SINEX Format [SINEX 2.02]. A number of format blocks may be taken directly from [SINEX 2.02], in particular:

```
FILE/REFERENCE
SITE/ID
SITE/RECEIVER
```

Some other format blocks are defined within this document:

```
BIAS/DESCRIPTION      (Mandatory)
BIAS/RECEIVER_GROUPS  (Optional)
BIAS/SOLUTION         (Mandatory)
```

The IGS ACs should submit daily files containing the estimated GNSS biases from all global sites and satellites. Only information directly connected to the bias estimates should be given.

2.2. Main Features of SINEX_BIAS

The `BIAS/SOLUTION` format structure of SINEX_BIAS V1.00 does allow the following main features:

- biases are specified for a given time interval of validity, defined by start and end time;
- biases may be augmented by their slope parameters;
- support of biases responding to: (i) *system*, (ii) *satellite*, (iii) *receiver*, (iv) *satellite-receiver*, and even (v) biases attributed to (user-defined) *receiver groups*;
- *differential* (relative) **or** *observable-specific* (pseudo-absolute) bias parameters;

- consideration of bias parameters with respect to *code* **and** *phase* observations;
- the possibility to define *GNSS observable groups* (to be treated with one common bias parameter).

The above listing of features shows a distinct **flexibility** for handling of any kind of GNSS bias values. It should be obvious that SINEX_BIAS should be well suited for further applications, such as PPP ambiguity resolution (PPP-AR), etc.

3. SINEX_BIAS File Naming

In the following, we provide a file naming convention for both *short* and *long* filenames. Filenames may be in *uppercase* or in *lowercase*. The filename extension should be: `.BIA` or `.bia` (conforming to the SINEX keyword "`BIA`" internally used).

3.1. Short Filenames

The files are named:

`CCCWWWWD.BIA` or `CCCYYDDD.BIA`

where

`CCC`:	3-figure Analysis Center (AC) designator
`WWWW`:	GPS week
`D`:	Day of week (0–6) or 7 for a weekly file
`YY`:	2-digit year
`DDD`:	Day of year

Examples: `COD18646.BIA[.gz]` or `cod15276.bia[.gz]`

3.2. Long Filenames

Based on a proposal for a new product naming convention worked out by colleagues from GFZ in analogy with the new RINEX naming scheme, we would propose to name the daily bias files in the following manner:

The full filename specification is given with:

`AAAVPPPTTT_YYYYDDDHHMM_LEN_SMP_CNT.FMT[.?*]`

```
01-03  AAA  3-char AC name (e.g.: DLR for "Deutsches Zentrum f r Luft- und Raumfahrt")
04       V  1-char version/solution identifier (here: nominally 0)
05-07  PPP  3-char campaign/project specification (e.g.: MGX)
08-10  TTT  3-char product type specification (e.g.: FIN for "final")
11     _    1-char separator (underscore)
12-15  YYYY 4-digit year of start epoch
16-18  DDD  3-digit day-of-year of start epoch
10-20  HH   2-digit hour of start epoch (here: 00)
```

```
21-22  MM   2-digit minute of start epoch (here: 00)
23     _    1-char separator (underline)
24-26  LEN  2-digits+1-char intended (nominal) product period
             (here: 01D for 1-day)
27     _    1-char separator (underline)
28-30  SMP  2-digits+1-char sampling interval
             (here: 01D for 1-day)
31     _    1-char separator (underscore)
32-34  CNT  3-char content type (here: "DSB")
35     .    1-char separator
36-38  FMT  3-char format extension (here: "BIA")

Optional:
39     .    extension
40-XX       compression file type (here: ".gz")
```

Example: `DLR0MGXFIN_20150010000_01L_01D_DSB.BIA.gz`

4. SINEX_BIAS Version 1.00—Detail Format Description

4.1. Header and Footer Lines (Mandatory)

```
Description:

The Header line must be the first line in a SINEX_BIAS file.
The Footer line must be the last  line in a SINEX_BIAS file.

Contents:
```

Field	Description	Format
File Identifier	%=BIA	A5
Format Version	Four digits indicating the version of SINEX_BIAS format used. '1.00' for this version.	1X,F4.2
File Agency Code	Identify the agency creating the file.	1X,A3
Time	Creation time of this SINEX_BIAS file (preferably in UTC).	1X,I2.2,':',I3.3,':',I5.5
Agency Code	Identify the agency providing the data in the SINEX_BIAS file.	1X,A3
Time	Start time of solution in the this SINEX_BIAS file (see also 'TIME SYSTEM' descriptor).	1X,I2.2,':',I3.3,':',I5.5
Time	End time of the solution in the this SINEX_BIAS file (see also 'TIME SYSTEM' descriptor).	1X,I2.2,':',I3.3,':',I5.5
Observation Code	Technique(s) used to generate the SINEX_BIAS solution. 'P' (GNSS) in case of SINEX_BIAS.	1X,A1

H_E_A_D_E_R___L_I_N_E

```
|                |                                   |              |
| Number of Est- | Number of parameters included in  |   1X,I5.5    |
| timates        | this SINEX_BIAS file.             |              |
|________________|___________________________________|______________|
|                |                                   |              |
| Constraint     | Single character indicating the   |   1X,A1      |
| Code           | constraint in the SINEX solution. |              |
|                | 0-fixed/tight constraints,        |              |
|                | 1-significant constraints,        |              |
|                | 2-unconstrained.                  |              |
|                | '2' in case of regular SINEX_BIAS;|              |
|                | '1' should be chosen in cases     |              |
|                |     with "internal" constraints,  |              |
|                |     e.g., if GLONASS ISB biases   |              |
|                |     are treated to be equal for   |              |
|                |     identical GLONASS frequency   |              |
|                |     channel numbers;              |              |
|                | '0' should  be chosen in cases    |              |
|                |     with "external" constraints,  |              |
|                |     e.g, if a number of specific  |              |
|                |     bias values was taken over    |              |
|                |     from an external source.      |              |
|                |     NOTE: Those values should be  |              |
|                |     included in the SINEX_BIAS    |              |
|                |     file (and indicated with STD  |              |
|                |     DEV values set to zero).      |              |
|________________|___________________________________|______________|
|                |                                   |              |
| Solution       | Specification of the bias file    |   1X,A9      |
| Contents       | contents. The corresponding key-  |              |
|                | word may be used to flag a bias   |              |
|                | file which contains non-specified |              |
|                | data records (for test purposes). |              |
|                | 'SINEX_BIA' indicates a regular   |              |
|                |             SINEX_BIAS file.      |              |
|                | Any other keyword indicates an    |              |
|                | experimental bias file (e.g. of   |              |
|                | a special project).               |              |
|________________|___________________________________|______________|
                                                     |              |
                                                     |     77       |
                                                     |______________|
```

```
 __________________________________________________________________
|_____________F_O_O_T_E_R___L_I_N_E________________________________|
|                |                                   |              |
|__Field_________|______Description__________________|___Format_____|
|                |                                   |              |
| File Identifier| %=ENDBIA                          |     A8       |
|________________|___________________________________|______________|
                                                     |              |
                                                     |     8        |
                                                     |______________|
```

4.2. BIAS/DESCRIPTION Block (Mandatory)

Description:

This block gives important parameters from the analysis and defines
the fields in the block 'BIAS/SOLUTION'.

Contents:

```
 __________________________________________________________________
|_________________BIAS/DESCRIPTION__D_A_T_A__L_I_N_E_______________|
|                |                                   |              |
|__Field_________|______Description__________________|___Format_____|
|                |                                   |              |
| Information    | Describes the type of information |   1X,A39     |
| Type           | present in the next field. May    |              |
|                | take on the following values:     |              |
|                |                                   |              |
```

```
|                 | 'OBSERVATION SAMPLING'               |                |
|                 |   - Observation sampling interval    |   1X,I12       |
|                 |     [sec] used for data analysis.    |                |
|                 |   Optional information.              |                |
|                 | 'PARAMETER SPACING'                  |                |
|                 |   - Parameter spacing interval       |   1X,I12       |
|                 |     [sec] used for parameter         |                |
|                 |     representation.                  |                |
|                 |   Optional information.              |                |
|                 | 'DETERMINATION METHOD'               |                |
|                 |   - Determination method used to     |   1X,A39       |
|                 |     generate the bias results.       |                |
|                 |     Recommended entries are:         |                |
|                 |     o 'DIRECT ESTIMATION'            |                |
|                 |       (analysis of observable        |                |
|                 |       differences only)              |                |
|                 |     o 'CLOCK ANALYSIS'               |                |
|                 |       (analyzing the ionosphere-     |                |
|                 |       free linear combination of     |                |
|                 |       the basic observables)         |                |
|                 |     o 'IONOSPHERE ANALYSIS'          |                |
|                 |       (analyzing the geometry-       |                |
|                 |       free/ionospheric linear        |                |
|                 |       combination)                   |                |
|                 |     o 'COMBINED ANALYSIS'            |                |
|                 |       (results from both clock       |                |
|                 |       and ionosphere analysis)       |                |
|                 |     o 'PPP BIAS ANALYSIS'            |                |
|                 |       (determination of biases       |                |
|                 |       suited for PPP-AR)             |                |
|                 |     o 'CALIBRATION'                  |                |
|                 |       (hardware calibration)         |                |
|                 |     o 'COMBINATION'                  |                |
|                 |       (results from a combination    |                |
|                 |       of various bias products)      |                |
|                 |   Mandatory information.             |                |
|                 | 'BIAS MODE'                          |                |
|                 |   - The bias mode describes how      |   1X,A39       |
|                 |     the included bias values have    |                |
|                 |     to be interpreted and            |                |
|                 |     applied, respectively.           |                |
|                 |     Possible modes are:              |                |
|                 |     o 'DIFFERENTIAL'                 |                |
|                 |     o 'OBSERVABLE-SPECIFIC'          |                |
|                 |     Obviously, this implies that     |                |
|                 |     inclusion of either              |                |
|                 |     o differential (relative) or     |                |
|                 |     o observable-specific (pseudo-|  |                |
|                 |     absolute) bias values is         |                |
|                 |     allowed in a SINEX_BIAS file.    |                |
|                 |   Mandatory information.             |                |
|                 | 'TIME SYSTEM'                        |                |
|                 |   - The time tags specified in       |   1X,A3        |
|                 |     the BIAS/SOLUTION block have     |                |
|                 |     be given in a common TIME        |                |
|                 |     SYSTEM.                          |                |
|                 |     Possible time systems are:       |                |
|                 |     o RINEX GNSS system flag         |                |
|                 |       (e.g. 'G  '),                  |                |
|                 |     o 'UTC' - Coordinated            |                |
|                 |       Universal Time,                |                |
|                 |     o 'TAI' - International          |                |
|                 |       Atomic Time.                   |                |
|                 |     NOTE: The declared 'TIME         |                |
|                 |     SYSTEM' should be consistent     |                |
|                 |     with the 'TIME SYSTEM ID'        |                |
|                 |     declared in an associated        |                |
|                 |     Clock-RINEX.                     |                |
|                 |   Compulsory information.            |                |
|                 | 'REFERENCE SYSTEM'                   |                |
|                 |   - Reference GNSS used for clock    |   1X,A1        |
|                 |     estimation. System code          |                |
|                 |     according to RINEX3 standards.|  |                |
|                 |     E.g.: 'G'                        |                |
```

```
|                |   Mandatory in case of clock      |              |
|                |   analysis, else optional.        |              |
|                | 'OBSERVABLE GROUP'                |              |
|                |   - GNSS flag,                    |   1X,A1,     |
|                |   - number of given observable    |              |
|                |     codes,                        |   2X,I4,     |
|                |   - list of observable codes.     | 6(1X,A4)     |
|                |     NOTE: The first code is used  |              |
|                |     as observable group code (to  |              |
|                |     be used for the assignment of |              |
|                |     the included bias results).   |              |
|                |     This implies that by adding   |              |
|                |     a non-existing RINEX3 code an |              |
|                |     extra observable group code   |              |
|                |     could be defined.             |              |
|                |     HINT: A leading '@' shall be  |              |
|                |     used to indicate an extra     |              |
|                |     observable group code (e.g.:  |              |
|                |     '@C1W').                      |              |
|                |   Optional information (to be     |              |
|                |   repeated for each desired       |              |
|                |   GNSS observable line).          |              |
|                | 'REFERENCE OBSERVABLES'           |              |
|                |   - Each involved GNSS,           |   1X,A1,     |
|                |   - reference code observable, or |   2X,A4,     |
|                |     group of the first frequency, |              |
|                |   - reference code observable, or |   1X,A4      |
|                |     group of the second frequency.|              |
|                |     NOTE: Observable codes have   |              |
|                |     to be declared following      |              |
|                |     RINEX3 standards (if it is    |              |
|                |     not a group code). Already    |              |
|                |     supported GNSS are:           |              |
|                |       G - GPS                     |              |
|                |       R - GLONASS                 |              |
|                |       E - Galileo                 |              |
|                |       J - QZSS                    |              |
|                |       C - BeiDou                  |              |
|                |       I - IRNSS                   |              |
|                |       S - SBAS payload            |              |
|                |     NOTE: In particular cases     |              |
|                |     (e.g. the case with GLONASS   |              |
|                |     ISB  biases specific to       |              |
|                |     satellite-receiver), the two  |              |
|                |     observable code fields may be |              |
|                |     '    ' as the selection of    |              |
|                |     observables may be considered |              |
|                |     for a user of a corresponding |              |
|                |     GLONASS clock product.        |              |
|                |   Mandatory data record (to be    |              |
|                |   repeated for multiple GNSS).    |              |
|                | 'ZERO-MEAN CONDITIONS'            |              |
|                |   - Each involved GNSS,           |   1X,A1,     |
|                |     number of effective zero-mean |              |
|                |     conditions:                   |              |
|                |     - total number. This number   |   2X,I4,     |
|                |       has to be the sum of such   |              |
|                |       conditions with respect to: | 6(1X,I4)     |
|                |       - system (all biases),      |              |
|                |       - satellite biases,         |              |
|                |       - receiver biases,          |              |
|                |       - satellite-receiver biases,|              |
|                |       - frequency channel number  |              |
|                |         dependence (e.g. GLONASS),|              |
|                |       - other.                    |              |
|                |   Optional data record (to be     |              |
|                |   repeated for multiple GNSS).    |              |
|                |                                   |              |
|                | Any of the above fields may be    |              |
|                | and in any order.                 |              |
|----------------|-----------------------------------|--------------|
                                                     |              |
                                                     |      80      |
                                                     |--------------|
```

4.3. BIAS/RECEIVER_GROUPS Block (Optional)

```
Description:

The satellite bias characteristics may be considerably different among
receivers. Therefore, it might make sense to group (for the computation of the
satellite biases) the receivers of all involved stations according to a
particular assignment scheme. The BIAS/RECEIVER_GROUPS block may be used to
provide a corresponding station list, giving the assignment of each involved
station (and each constellation) to the appropriate receiver group.

Contents:
      ___________________________________________________________________
     |___________________BIAS/RECEIVER_GROUPS__D_A_T_A__L_I_N_E__________|
     |                |                                  |               |
     |__Field_________|______Description_________________|___Format______|
     |                |                                  |               |
     | Station Name   | Station codes are encoded using a|   1X,A9       |
     | Identifier     | 9-character field.               |               |
     |                | NOTE: For backward compatibility,|               |
     |                | left-aligned 4-character station |               |
     |                | codes are also permitted.        |               |
     |                | A blank field would be allowed   |               |
     |                | for a general assignment (just on|               |
     |                | the basis of receiver type and   |               |
     |                | firmware version).               |               |
     |________________|__________________________________|_______________|
     |                |                                  |               |
     | Constellation  | Constellation code:              |   1X,A1       |
     |                |   G - GPS                        |               |
     |                |   R - GLONASS                    |               |
     |                |   E - Galileo                    |               |
     |                |   J - QZSS                       |               |
     |                |   C - BeiDou                     |               |
     |                |   I - IRNSS                      |               |
     |                |   S - SBAS payload               |               |
     |                | A blank field would indicate no  |               |
     |                | constellation dependence.        |               |
     |________________|__________________________________|_______________|
     |                |                                  |               |
     | Receiver Group | Left-aligned receiver group name |   1X,A9       |
     | Identifier     | with a leading '@' (specific to  |               |
     |                | the given constellation).        |               |
     |                | Mandatory field.                 |               |
     |________________|__________________________________|_______________|
     |                |                                  |               |
     | Time           | Start time for the assignment of |   1X,I2.2,    |
     |                | a station to a receiver group.   |   ':',I3.3,   |
     |                |                                  |   ':',I5.5    |
     |________________|__________________________________|_______________|
     |                |                                  |               |
     | Time           | End time for the assignment.     |   1X,I2.2,    |
     |                |                                  |   ':',I3.3,   |
     |                |                                  |   ':',I5.5    |
     |________________|__________________________________|_______________|
     |                |                                  |               |
     | Receiver Type  | Receiver type (c.f. the naming   |   1X,A20      |
     |                | conventions for IGS equipment    |               |
     |                | descriptions, rcvr_ant.tab)      |               |
     |                | Mandatory field.                 |               |
     |________________|__________________________________|_______________|
     |                |                                  |               |
     | Receiver       | Receiver firmware version        |   1X,A20      |
     | Firmware       | (preferably left-aligned).       |               |
     |                | A blank field might be possible. |               |
     |________________|__________________________________|_______________|
                                                         |               |
                                                         |     90        |
                                                         |_______________|

Example:

*-------------------------------------------------------------------------------
```

```
+BIAS/RECEIVER_GROUPS
*STATION__ C GROUP____ DATA_START__ DATA_END____ RECEIVER_TYPE_______ RECEIVER_FIRMWARE___
 MAO0      G @MP0      15:276:00000 15:276:86399 JAVAD TRE-G3TH DELTA 3.6.4
 SIN0      G @MP0      15:276:00000 15:276:86399 JAVAD TRE-G3TH DELTA 3.6.4
 SIN1      G @MP1TRI   15:276:00000 15:276:86399 TRIMBLE NETR9        5.10
 STFU      G @MP1JAV-1 15:276:00000 15:276:86399 JAVAD TRE-G3TH DELTA 3.6.4
 TEST      G @MP1JAV-2 15:276:00000 15:276:86399 JAVAD TR_VS          3.6.4
 XYYX      G @MP1TRI   15:276:00000 15:276:86399 TRIMBLE NETR5        4.93
 WTZZ      G @MP_      15:276:00000 15:276:86399 JAVAD TRE-G3TH DELTA 3.6.4
 MAO0      E @ALL      15:276:00000 15:276:86399 JAVAD TRE-G3TH DELTA 3.6.4
 SIN0      E @ALL      15:276:00000 15:276:86399 JAVAD TRE-G3TH DELTA 3.6.4
 SIN1      E @ALL      15:276:00000 15:276:86399 TRIMBLE NETR9        5.10
 STFU      E @ALL      15:276:00000 15:276:86399 JAVAD TRE-G3TH DELTA 3.6.4
 TEST      E @ALL      15:276:00000 15:276:86399 JAVAD TR_VS          3.6.4
 WTZZ      E @ALL      15:276:00000 15:276:86399 JAVAD TRE-G3TH DELTA 3.6.4
*-------------------------------------------------------------------------------
*LEGEND:   G @MP0      Receivers with disabled multipath (MP) mitigation.
*LEGEND:   G @MP1JAV-1 JAVAD TRE-G3TH receivers with MPNEW   MP mitigation enabled.
*LEGEND:   G @MP1JAV-2 JAVAD TRIUMPH  receivers with MPNEW   MP mitigation enabled.
*LEGEND:   G @MP1TRI   TRIMBLE        receivers with Everest MP mitigation enabled.
*LEGEND:   G @MP_      Extra group with unknown MP mitigation mode.
*LEGEND:   E @ALL      No grouping for the indicated system.
*-------------------------------------------------------------------------------
-BIAS/RECEIVER_GROUPS
*-------------------------------------------------------------------------------
+BIAS/SOLUTION
*BIAS SVN_ PRN STATION__ OBS1 OBS2 BIAS_START__ BIAS_END____ UNIT __ESTIMATED_VALUE____ _STD_DEV___ __ESTIMATED_SL
 DSB  G001 G01 @MP0      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  G001 G01 @MP1TRI   C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  G001 G01 @MP1JAV-1 C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  G001 G01 @MP1JAV-2 C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  G001 G01 @MP_      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  G002 G02 @MP0      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  G002 G02 @MP1TRI   C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  G002 G02 @MP1JAV-1 C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  G002 G02 @MP1JAV-2 C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  G002 G02 @MP_      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  E001 E01 @ALL      C1X  C5X  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 DSB  E002 E02 @ALL      C1X  C5X  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
-BIAS/SOLUTION
*-------------------------------------------------------------------------------
```

An adequate LEGEND has to be included using COMMENT lines. The above example gives an idea how such a LEGEND sequence could be arranged (preferably in a quasi-standardized, human readable format).

4.4. BIAS/SOLUTION Block (Mandatory)

Description:

This block contains the bias estimates for all time intervals, or epochs.

Contents:

```
 _________________________________________________________________________
|__________________BIAS/SOLUTION__D_A_T_A__L_I_N_E_________________________|
|                 |                                   |              |
|__Field_________|______Description___________________|___Format_____|
|                 |                                   |              |
| BIAS            | Bias type identifier.             |   1X,A4      |
|                 | Available types are:              |              |
|                 |   'OSB ': Observable-specific     |              |
|                 |           Signal Bias (OSB);      |              |
|                 |   'DSB ': Differential Signal     |              |
|                 |           Bias (DSB);             |              |
|                 |   'ISB ': Ionosphere-free (linear |              |
|                 |           combination) Signal     |              |
|                 |           Bias (ISB).             |              |
|                 | Mandatory field.                  |              |
|_________________|___________________________________|______________|
|                 |                                   |              |
| SVN             | Satellite SVN code "CNNN":        |   1X,A4      |
```

```
|                |   "C"   - satellite system flag     |              |
|                |           (according to RINEX3);    |              |
|                |   "NNN" - SVN number (or GLONASS    |              |
|                |           number).                  |              |
|                | Satellite system flag "C" is        |              |
|                | mandatory in any case.              |              |
|----------------|-------------------------------------|--------------|
|                |                                     |              |
| PRN            | Satellite PRN code "CNN":           |   1X,A3      |
|                |   "C"   - satellite system flag     |              |
|                |           (according to RINEX3);    |              |
|                |   "NN"  - PRN number (or slot       |              |
|                |           number for GLONASS).      |              |
|                | Satellite system flag "C" is        |              |
|                | mandatory in any case.              |              |
|----------------|-------------------------------------|--------------|
|                |                                     |              |
| Station Name   | Station codes are encoded using a   |   1X,A9      |
| Identifier     | 9-character field (or a receiver    |              |
| Identifier     | group name).                        |              |
|                | NOTE: For backward compatibility,   |              |
|                | left-aligned 4-character station    |              |
|                | codes are also permitted.           |              |
|----------------|-------------------------------------|--------------|
|                |                                     |              |
| OBS1 and OBS2  | Observables used for estimating     | 2(1X,A4)     |
| Observable     | the biases. The observable codes    |              |
| Codes          | have to be given according to       |              |
|                | RINEX3 format definitions. If       |              |
|                | 'BIAS MODE' is declared with        |              |
|                | 'OBSERVABLE-SPECIFIC', only OBS1    |              |
|                | is given (and OBS2 field remains    |              |
|                | blank).                             |              |
|                |                                     |              |
|                | IMPORTANT NOTE: Please be aware     |              |
|                | that distinction between            |              |
|                | - code (or pseudorange) and         |              |
|                | - phase biases                      |              |
|                | is done on the basis of the given   |              |
|                | GNSS observable codes!              |              |
|----------------|-------------------------------------|--------------|
|                |                                     |              |
| Time           | Start time for the bias estimate.   |   1X,I2.2,   |
|                |                                     |   ':',I3.3,  |
|                |                                     |   ':',I5.5   |
|                | NOTE: The time tags specified       |              |
|                | here have to be given in a common   |              |
|                | time system (see also 'TIME         |              |
|                | SYSTEM' descriptor).                |              |
|----------------|-------------------------------------|--------------|
|                |                                     |              |
| Time           | End time for the bias estimate.     |   1X,I2.2,   |
|                |                                     |   ':',I3.3,  |
|                |                                     |   ':',I5.5   |
|----------------|-------------------------------------|--------------|
|                |                                     |              |
| Unit           | Bias estimates are given in the     |   1X,A4      |
|                | specified unit. Unit has to be      |              |
|                | 'ns' (nanoseconds).                 |              |
|----------------|-------------------------------------|--------------|
|                |                                     |              |
| Bias Parameter | Estimated (offset) value of the     |   1X,E21.15  |
| Estimate       | bias parameter.                     |              |
|----------------|-------------------------------------|--------------|
|                |                                     |              |
| Bias Parameter | Estimated standard deviation for    |   1X,E11.6   |
| Standard       | the bias parameter.                 |              |
| Deviation      | NOTE: Bias values taken over from   |              |
|                | an external source should be        |              |
|                | indicated with a zero value.        |              |
|----------------|-------------------------------------|--------------|
|                |                                     |              |
| Slope          | Estimated value of the slope        |   1X,E21.15  |
| Estimate       | parameter (in ns/n).                |              |
```

```
|                 | Optional (else blank).             |              |
|_________________|____________________________________|______________|
|                 |                                    |              |
| Slope           | Estimated standard deviation for   |   1X,E11.6   |
| Standard        | the slope parameter (in ns/s).     |              |
| Deviation       | Optional (else blank).             |              |
|_________________|____________________________________|______________|
                                                       |              |
                                                       |     133      |
                                                       |______________|
```

4.4.1. YY:DDD:SSSSS Time Tags

Please note that time tags are commonly given in a `YY:DDD:SSSSS` formatted representation (see also Appendix B, specifically Sections B.2, B.3.2).

```
 ___________________________________________________________________
|                 |                                    |              |
|__Field__________|______Description___________________|___Format_____|
|                 |                                    |              |
| Time            | YY:DDD:SSSSS.  "UTC"               |   I2.2,      |
|                 | YY = last 2 digits of the year,    |   ':',I3.3,  |
|                 | if YY <= 50 implies 21-st century, |   ':',I5.5   |
|                 | if YY > 50 implies 20-th century,  |              |
|                 | DDD = 3-digit day in year,         |              |
|                 | SSSSS = 5-digit seconds in day.    |              |
|_________________|____________________________________|______________|
```

Remark: `':'` corresponds to `1H:` (as originally used in the SINEX detail format descriptions).

4.4.2. COMMENT Lines and Floating Number Exponent

COMMENT lines starts with "`*`" in Col. 1 and can be anywhere within or outside a block, though for the clarity sake, beginning and ends of blocks are preferable.

For increased portability, the floating number exponent of "`E`" should be used rather than "`D`" or "`d`" which is not recognized by some compiler/installations.

See also: Appendix B, specifically Sections B.2, B.3.2, B.3.4.

5. General Notes on Bias Handling

5.1. Bias Parameter Representation in the Time Domain

- Biases are specified for a given time interval of validity, defined by start and end time.
- Biases may be augmented by their slope parameters.
- If a slope parameter is specified, the bias is referring to the middle of the given time interval.

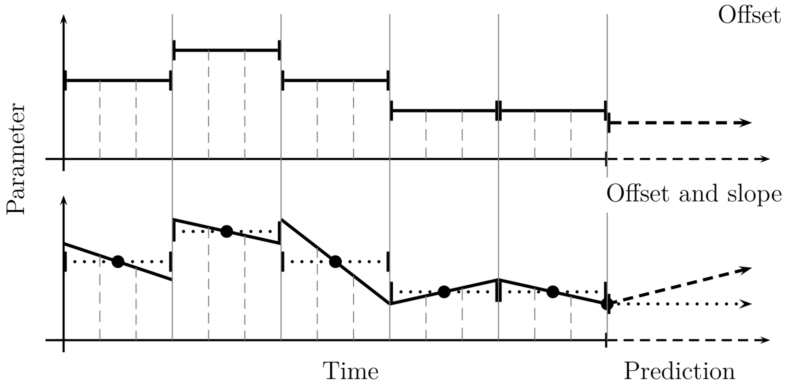

Figure 1: Bias parameter representation *without* (top) and *with* slopes (bottom), as supported by the Bias-SINEX V1.00.

- In case of open interval, when end time is indicated as undefined, the bias refers to the start time of the interval.
- In case of open interval, when start time is indicated as undefined, the bias refers to the end time of the interval.
- The unit of the slope has to be ns per s (ns/s).

Figure 1 shows the situation with *offsets only* (top) and with *offsets and slopes* (bottom). The bottom subfigure of Figure 1 indicates that, in principle, Bias-SINEX V1.00 would allow to provide bias parameter information *without discontinuities* (at the time interval boundaries).

Furthermore, it should be obvious that, in the extreme case, provision of epoch bias parameters is possible (by shortening the time intervals accordingly). For an epoch(-specific) bias product, `OBSERVATION SAMPLING` and `PARAMETER SPACING` are assumed to be equal.

5.2. Notes on SVN/PRN and STATION Usage in BIAS/SOLUTION Block

The fields SVN/PRN and STATION may used for coding of biases with four different characteristics:

- **Satellite bias:** If a bias depends only on a satellite, SVN/PRN should be filled, STATION may be left empty.
- **Station bias:** If a bias depends only on a station and a particular GNSS, STATION should be filled and SVN/PRN should have the system code only (e.g. “G”, “R”, “E” for GPS, GLONASS, Galileo).

- **Satellite-station (satellite-receiver) bias:** If a bias depends on both satellite and station, all three fields, SVN/PRN/STATION, should be used.
- **System bias:** If a bias depends only on a particular GNSS, SVN/PRN should have the system code only (e.g. “G”, “R”, “E” for GPS, GLONASS, Galileo).

Examples for the four cases (listed above) may look like:

```
*-------------------------------------------------------------------------------
+BIAS/SOLUTION
*BIAS SVN_ PRN STATION__ OBS1 OBS2 BIAS_START__ BIAS_END____ UNIT __ESTIMATED_VALUE____ _STD_DEV___ __ESTIMATED_SL
 DSB  G063 G01           C1W  C1C  15:276:00000 15:276:86399 ns   0.148022937908458E+01 .398201E-01
 ISB  C    C   ABMF      C1I  C7I  15:276:00000 15:276:86399 ns   0.240909461328850E+02 .835246E+00
 ISB  R730 R01 AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.104868834341878E+02 .101419E+01
 ISB  G    G             C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
-BIAS/SOLUTION
*-------------------------------------------------------------------------------
```

5.3. Definition of GNSS Observable Groups

The possibility to define specific *GNSS observable groups* is an additional feature of Bias-SINEX V1.00. RINEX3 observables that showed similar (satellite) bias characteristics may be assigned to a common *observable group* by defining a corresponding OBSERVABLE GROUP data record in the BIAS/DESCRIPTION block.

Note and Hint

The first code is used as observable group code (to be used for the assignment of the included bias results). This implies that by adding a non-existing RINEX3 code an extra observable group code could be defined. A leading “” shall be used to indicate an extra observable group code (e.g.: “C1W”).

5.4. Definition of GNSS Receiver Groups

The need for a possibility to define *receiver groups* (or families) came up during the discussions at the IGS Bias Workshop 2015. In order to handle satellite bias information specific to individual receiver (or station) groups, a dedicated (optional) SINEX block, BIAS/RECEIVER_GROUPS, was added to Bias-SINEX V1.00.

Question: Should it be allowed to leave the STATION field in the BIAS/RECEIVER_GROUPS block empty in order to provide any (initial) bias information specific to a list of receiver types (and firmware versions) (e.g. GLONASS DCPB information)?

If receivers are distinguished not for all constellations, then one could introduce either (a) an accumulative group name (e.g. “All”) or (b) no group for such constellations. For better readability, variant (a) should be preferred.

Even though the SINEX_BIAS Format would allow to describe a *residual* satellite bias parameter, $\delta B_{\text{satellite(receiver\_group)}}$, following

$$B_{\text{total}} = B_{\text{satellite}} + \delta B_{\text{satellite(receiver\_group)}} + B_{\text{receiver}}, \tag{1}$$

the above given bias parameter representation should be avoided (as the separation of all components may become rather complicated). Based on receiver-group-specific satellite bias parameters, $B_{\text{satellite(receiver\_group)}}$, the total bias, B_{total}, should be represented as follows:

$$B_{\text{total}} = B_{\text{satellite(receiver\_group)}} + B_{\text{receiver}}. \tag{2}$$

5.5. Order of BIAS/SOLUTION Data Records

BIAS/SOLUTION data records may be listed in any arbitrary order. However, we recommend to list the included bias parameters starting with those responding to (i) system, (ii) satellite, (iii) receiver, (iv) satellite-receiver, (v) other. Furthermore, to keep the bias parameters in chronological (and alphabetical) order may be helpful.

6. Basic Definitions and Rules Concerning GNSS Biases

6.1. Sign Convention

The following sign convention is used for bias values:

$$\text{bias} = \text{observation} - \text{true (or unbiased) observation} \tag{3a}$$
$$\text{observation} = \text{true observation} + \text{bias} \tag{3b}$$
$$\text{true observation} = \text{observation} - \text{bias} \tag{3c}$$

Numerical example: ground truth 11, observed 7, bias (or error) −4.

6.2. Bias Arithmetics

In the following, B is used to address a bias value (or parameter). O denotes an observation value.

6.2.1. Basic Bias Equation

Using this notation, we may write:

$$\tilde{O}_{\text{true}} = O_{\text{observed}} - B. \tag{4}$$

6.2.2. Satellite and Receiver Bias Components (and Total Bias)

The **total bias** (or overall bias), if a separation into a satellite component, $B_{\text{satellite}}$, and into a receiver component, B_{receiver}, is assumed, is defined as follows:

$$B_{\text{total}} = B_{\text{satellite}} + B_{\text{receiver}} \tag{5}$$

6.2.3. GNSS Signal Bias

We use the following notation to address a GNSS signal bias:

$$B_{(\text{constellation},\text{observable})}. \tag{6}$$

For example, $B_{(\text{G},\text{C1W})}$ would correspond to a bias for the GPS (G) code (C) first-frequency (1) W-tracking (W) observable.

6.3. Three Types of Signal Biases

We distinguish between three types of signal biases:

- **Observable-specific Signal Bias**, labeled with **OSB**, or $B_{\text{O}(\text{constellation},\text{observable})}$;
- **Differential Signal Bias**, labeled with **DSB**, or $B_{\text{D}(\text{constellation},\text{observable1},\text{observable2})}$;
- **Ionosphere-free linear combination Signal Bias**, or simply **Ionosphere-free Signal Bias**, labeled with **ISB**, or $B_{\text{I}(\text{constellation},\text{observable1},\text{observable2})}$.

The terminology introduced here is based on the outcome of a dedicated e-mail discussion carried out after the Bias Workshop 2015. The (previously used) term "Code," was replaced by "Signal," as the SINEX_BIAS Format now also support biases with respect to GNSS phase observations.

Terms, such as, DCB, DPB, DCPB (introduced at the Bias Workshop 2012), OCB, OPB are (officially) not used in this format document, but they still may be used in an informal context. However, IFB (Inter-Frequency Bias) and ISB (Inter-System Bias) should, as far as possible, no longer be used. Note that ISB now stands for Ionosphere-free (linear combination) Signal Bias. IFB was open misused for (interfrequency) DCB, but, in fact, it had to be interpreted as "GLONASS-dedicated ISB".

6.3.1. Differential Signal Bias (DSB)

A Differential Signal Bias corresponds to the difference of two Signal Biases (that are commonly inaccessible in the absolute sense). An example for a DSB is:

$$B_{\text{D}(\text{G},\text{C1W},\text{C1C})} = B_{(\text{G},\text{C1W})} - B_{(\text{G},\text{C1C})} \tag{7}$$

Using Equation (7), we may show that direct estimation of $B_{\mathrm{D(G,C1W,C1C)}}$ is possible by analyzing the difference of $O_{\mathrm{(G,C1W)}}$ and $O_{\mathrm{(G,C1C)}}$ observation data:

$$B_{\mathrm{D(G,C1W,C1C)}} = (O_{\mathrm{(G,C1W)}} - \tilde{O}_{\mathrm{(G,C1)}}) - (O_{\mathrm{(G,C1C)}} - \tilde{O}_{\mathrm{(G,C1)}}) = O_{\mathrm{(G,C1W)}} - O_{\mathrm{(G,C1C)}} \tag{8}$$

where $\tilde{O}_{\mathrm{(G,C1)}}$ is used to denote the true (or unbiased) observations.

Such a DSB correction may be applied in the following way:

$$O_{\mathrm{(G,C1W)}} = O_{\mathrm{(G,C1C)}} + B_{\mathrm{D(G,C1W,C1C)}} \tag{9}$$

Differential Signal Biases between different signal frequencies are, of course, also foreseen, e.g.:

$$B_{\mathrm{D(G,C1W,C2W)}} = B_{\mathrm{(G,C1W)}} - B_{\mathrm{(G,C2W)}}. \tag{10}$$

There is a common rule that interfrequency DSBs are declared for the selected reference observables.

6.3.2. Ionosphere-free Signal Bias (ISB)

The Ionosphere-free Signal Bias (ISB) has to be interpreted as

$$B_{\mathrm{I(G,C1W,C2W)}} = \kappa_1 B_{\mathrm{(G,C1W)}} + \kappa_2 B_{\mathrm{(G,C2W)}}, \tag{11}$$

where κ_1 and κ_2 are the two factor used for the computation of the ionosphere-free linear combination. To be more specific, $\kappa_1 = \nu_1^2/(\nu_1^2 - \nu_2^2) = 2.546$, $\kappa_2 = -\nu_2^2/(\nu_1^2 - \nu_2^2) = -1.546$ (for GPS); ν_i is the frequency of the i-th carrier. GPS C1W and C2W observables are assumed in this example.

6.3.3. Observable-specific Signal Bias (OSB)

Using Equations (11) and (10) we may write the following equation system:

$$B_{\mathrm{I(G,C1W,C2W)}} = \kappa_1 B_{\mathrm{O(G,C1W)}} + \kappa_2 B_{\mathrm{O(G,C2W)}} \tag{12a}$$

$$B_{\mathrm{D(G,C1W,C2W)}} = B_{\mathrm{O(G,C1W)}} - B_{\mathrm{O(G,C2W)}} \tag{12b}$$

The first equation describes the relationship of the Observable-specific Signal Biases (OSBs), $B_{\mathrm{O(G,C1W)}}$ and $B_{\mathrm{O(G,C2W)}}$, for the ionosphere-free case (clock analysis), the second equation in accordance with the geometry-free case (ionosphere analysis). The equation system describes the parameter transformation from OSB to ISB/DSB bias representation.

The inverse parameter transformation, from differential (relative) ISB/DSB to observable-specific (pseudo-absolute) OSB, may be derived by inversion of the matrix specified above:

$$B_{\mathrm{O(G,C1W)}} = B_{\mathrm{I(G,C1W,C2W)}} + \kappa_2 B_{\mathrm{D(G,C1W,C2W)}} \quad (13a)$$

$$B_{\mathrm{O(G,C2W)}} = B_{\mathrm{I(G,C1W,C2W)}} - \kappa_1 B_{\mathrm{D(G,C1W,C2W)}}. \quad (13b)$$

Let us give a numerical example. The following OSB values, $B_{\mathrm{O(G,C1W)}} = +10.73\,\mathrm{ns}$ and $B_{\mathrm{O(G,C2W)}} = +15.73\,\mathrm{ns}$, are conform to the following ISB/DSB values, $B_{\mathrm{I(G,C1W,C2W)}} = +3\,\mathrm{ns}$ and $B_{\mathrm{D(G,C1W,C2W)}} = -5\,\mathrm{ns}$.

For a user, consideration of an OSB bias correction would be very convenient, as just the observable type has to be known, e.g.:

$$O_{\mathrm{(G,C1(ref))}} = O'_{\mathrm{(G,C1)}} = O_{\mathrm{(G,C1C)}} - B_{\mathrm{O(G,C1C)}}, \quad (14)$$

where, assuming GPS C1W/C2W reference observables, $O'_{\mathrm{(G,C1)}} = O_{\mathrm{(G,C1W)}} - B_{\mathrm{O(G,C1W)}}$.

A reader of this document should be aware of the fact that GNSS Signal Biases are commonly inaccessible in the *absolute* sense. This implies that, taking the example with $B_{\mathrm{O(G,C1C)}}$, $B_{\mathrm{O(G,C1C)}} \neq B_{\mathrm{(G,C1C)}}$, meaning that that any OSB, B_{O}, may be expected to be shifted by an arbitrary offset, ΔB, with respect to the (commonly unavailable and thus unknown) true bias, B:

$$B = B_{\mathrm{O}} + \Delta B. \quad (15)$$

Therefore, Observable-specific Signal Biases B_{O} have to be interpreted as *pseudo-absolute* bias information.

The same is obviously also valid for: $O' \neq \tilde{O}$. To be more specific, OSB-corrected observations are **not** conforming with true observations, meaning that, for the above chosen example, $O'_{\mathrm{(G,C1)}} \neq \tilde{O}_{\mathrm{(G,C1)}}$.

Important Notes:

For *pseudo-absolute* bias values, the selection of the reference observables is absolutely essential.

- **Pro:** A user may just consider bias correction values specific to the given observable types.
- **Con:** OSB-corrected observations are consistent to the original definition of the reference observables—and, consequently, consistent to a GNSS clock product relying on the same definition.

6.4. GPS Group Delay

It is worth mentioning that Equation (13a) actually corresponds to the relationship between the interfrequency "group delays," τ_{GD}, broadcast by the GPS system and the interfrequency satellite DSB, $B_{(\mathrm{G,C1W,C2W})}$:

$$\tau_{\mathrm{GD}} = \kappa_2 \, B_{(\mathrm{G,C1W,C2W})} + \tau_0. \tag{16}$$

There may be an arbitrary offset, indicated by τ_0. Consequently, the size of τ_{GD} corresponds to the single-frequency pseudorange correction according to Equation (13a) (strictly speaking only for $O_{(\mathrm{G,C1W})}$, not for $O_{(\mathrm{G,C1C})}$ observations, assuming GPS satellite clock information being consistent to $B_{\mathrm{I(G,C1W,C2W)}} = 0$.

6.5. Datum Definition for ISB Bias Parameters in Multi-GNSS Clock Analysis

ISB bias parameters of more than one GNSS considered are directly connected with respect to each other. A clear definition of the ISB bias datum is therefore needed. As a consequence of this, we suggest that those receiver ISB bias parameters which are assumed to be zero must be explicitly included and listed in a SINEX_BIAS file (see, e.g., Example #7). Note that this should concern all ISB bias parameters with respect to the given "REFERENCE SYSTEM" and stations/receivers with the given "REFERENCE OBSERVABLES" (of that reference system). Last but not least, we may argue that the inclusion of "zero-valued", or "reference" receiver ISB bias parameters is not only a cosmetic issue. To have corresponding "reference" observable codes available (for the respective observation pair used) and to see whether a respective observation pair was actually used, respectively, are strong reasons that legitimate this requirement (of inclusion).

There seems to be no necessity for an inclusion of corresponding "reference" satellite ISB bias parameters. Nevertheless, the provision of corresponding satellite ISB information in SINEX_BIAS is self-evident and, therefore, actually may be strongly recommended—as the datum definition as imposed on the bias solution then becomes crystal-clear to a user of such a bias product.

6.6. GPS Observables From Cross-Correlation Receivers in RINEX2 and CC2NONCC

Cross-correlation receivers (or simply CC-receivers) provide under Antispoofing (AS) a particular code (or pseudorange) observable for the second frequency. Using the RINEX2 notation, the recorded observable, here called P2', may be written as:

$$\mathrm{P2'} = \mathrm{C1} + (\mathrm{P2} - \mathrm{P1}) \tag{17}$$

However, such observables are labeled in RINEX2 observation files with P2 (in RINEX3 unambiguously with C2D). It is therefore necessary to apply corresponding DSB corrections to C1 and P2' (in order to make them consistent to P1 and P2):

$$P1 = C1 + B_{\text{P1-C1}} \tag{18a}$$

$$P2 = P2' + B_{\text{P1-C1}} \tag{18b}$$

where $B_{\text{P1-C1}}$ denotes the satellite P1-C1 DSB information (as provided, e.g, by CODE [Schaer, 2001]).

CC2NONCC, originally developed by Jim Ray, was a RINEX2 observation conversion utility for exactly this (P1–C1) bias correction. This utility program should no longer be used. P1–C1 bias information should be considered directly by the analysis software.

It should be emphasized that IGS ACs processing RINEX2 observation files (e.g. as part of a reprocessing effort) are actually forced to consider the list of concerned CC-receivers from a separate metadata file.

The list of known cross-correlation (CC) receivers (following the IGS naming convention as given in `rcvr_ant.tab`) includes:

```
AOA ICS-4000Z
ROGUE SNR-12
ROGUE SNR-12 RM
ROGUE SNR-8
ROGUE SNR-800
ROGUE SNR-8000
ROGUE SNR-8100
ROGUE SNR-8C
SPP GEOTRACER100
TOPCON GP-DX1
TOPCON TT4000SSI
TRIMBLE 4000SSE
TRIMBLE 4000SSI
TRIMBLE 4000SST
```

When using a wildcard character "`*`", the CC-receiver list may be reduced to:

```
AOA ICS-4000Z
ROGUE*
SPP GEOTRACER100
TOPCON GP-DX1
TOPCON TT4000SSI
TRIMBLE 4000SS*
```

CC-receivers behave differently if Antispoofing (AS) is turned off. Instead of C1/P2', P1/P2 may be expected. For this reason, a list of AS-free periods might be useful (especially for reprocessings):

```
! Check whether time argument in a AS-free period
! ------------------------------------------------
  IF ((mjd >           0d0 .AND. mjd < 49383.00000d0) .OR. &
      (mjd > 49826.87499d0 .AND. mjd < 49847.83334d0) .OR. &
      (mjd > 49886.99999d0 .AND. mjd < 49909.00002d0) .OR. &
      (mjd > 49999.99999d0 .AND. mjd < 50022.00001d0) .OR. &
      (mjd > 50480.99999d0 .AND. mjd < 50503.00000d0)) THEN
    asmode = 0
  ENDIF
```

7. How to Use a SINEX_BIAS File

(Here, a corresponding flowchart could be added, summarizing the most important steps when using the information from a SINEX_BIAS file.)

8. Additional Remarks

8.1. "__X" Observable Issue

RINEX3 includes a clear definition of 3-character observable codes with respect to each supported GNSS system. However, one may have a suspicion that some receiver manufacturer misuse the third character of the corresponding RINEX3 observable code, i.e., they give an "`X`", independent of the tracking mode that was effectively used.

It will be one of the tasks for the IGS Bias and Calibration Working Group (BCWG) to identify such cases of misuse.

Additional Notes:

At CODE/AIUB, there is a dedicated analysis method (referred to as "(P1–C1) DCB multiplier" method) available for reliable determination of the (GPS) receiver tracking class [Schaer, 2002]. Corresponding anomalies (in RINEX2 observation data) could be revealed by CODE/AIUB in the past (see, e.g., [Ray, 2002]).

It is obvious that such a method might also be used for verification of all available GNSS observable declarations (made in RINEX3 observation files). It is intended to further develop the current RINEX2-oriented approach to a generalized ("GNSS code bias multiplier") approach for RINEX3 observation data.

How to handle known GNSS observables with unknown tracking mode? In the extreme case, one could think about treating affected observables in a **receiver-group** or even in a **GLONASS-like** mode, where pseudorange biases are treated **satellite-receiver-group-specific** and **satellite-receiver-specific**, respectively.

References

Gendt, G. (1997): *SINEX_TRO—Solution (Software/technique) INdependent EXchange Format for combination of TROpospheric estimates Version 0.01*, March 1, 1997: `https://igscb.jpl.nasa.gov/igscb/data/format/sinex_tropo.txt`

Ray, J. (2001): *Updated P1-C1 pseudorange bias corrections*, IGSMAIL #3160, January 5, 2001.

Ray, J. (2002): *C1/P1 biases for Leica and Trimble 5700 receivers*, IGSMAIL #3737, February 13, 2002.

RINEX: The Receiver Independent Exchange Format Version 3.03:
`ftp://igscb.jpl.nasa.gov/igscb/data/format/rinex303.pdf`

RINEX Extensions to Handle Clock Information Version 3.00/3.02:
`ftp://igscb.jpl.nasa.gov/igscb/data/format/rinex_clock300.txt`
`ftp://igscb.jpl.nasa.gov/igscb/data/format/rinex_clock302.txt`

SINEX—Solution (Software/technique) INdependent EXchange Format Version 2.02:
`http://www.iers.org/IERS/EN/Organization/AnalysisCoordinator/analysis.html`

Schaer, S. (2001): *CODE DCB archive initiated*, IGSMAIL #3212, February 23, 2001.

Schaer, S. (2002): *TRIMBLE 4700*, IGSMAIL #3887, May 18, 2002.

Schaer, S. (2012): *From differential to absolute code biases*. Workshop on GNSS Biases, Uni Bern, 18–19 January 2012.

Schaer, S. (2014): *Biases Relevant to GPS and GLONASS Data Processing*. IGS Workshop 2014, June 26, Pasadena, California, USA.

Springer, T. (2011): *SINEX_BIAS—Solution (Software/technique) INdependent EXchange Format for GNSS Biases Version 0.01*, June 29, 2011.

Appendix A Examples for Submissions of Bias Estimates in Bias-SINEX V1.00

A.1 Example #0: Original Bias-SINEX V0.01 example updated to V1.00 standards

```
%=BIA 1.00 PF2 11:180:59736 PF2 11:113:86385 11:114:86385 P 04774 2 SINEX_BIA
*-------------------------------------------------------------------------------
* Bias Solution INdependent EXchange Format (Bias-SINEX)
*-------------------------------------------------------------------------------
+FILE/REFERENCE
 REFERENCE FRAME    IGS08
 DESCRIPTION        European Space Operation Center (ESOC)
 INPUT              ESOC solutions in normal equation format
 OUTPUT             ESOC solutions in Bias-SINEX format
 CONTACT            Tim.Springer@esa.int.nospam
 HARDWARE           Linux dgnl2 2.6.27.19-5-default #1 SMP 2009-02-28 04:40:21
 SOFTWARE           Napeos 3.6 TAS 07/06/2011
-FILE/REFERENCE
*-------------------------------------------------------------------------------
+BIAS/DESCRIPTION
*KEYWORD________________________________ VALUE(S)_______________________________
 OBSERVATION SAMPLING                            300
 PARAMETER SPACING                             86400
 DETERMINATION METHOD                    CLOCK ANALYSIS
 BIAS MODE                               DIFFERENTIAL
 TIME SYSTEM                             G
 REFERENCE SYSTEM                        G
 REFERENCE OBSERVABLES                   E  C1C  C7Q
 REFERENCE OBSERVABLES                   G  C1W  C2W
 ZERO-MEAN CONDITIONS                    G     0    0    0    0    0    0    0
 ZERO-MEAN CONDITIONS                    E     1    0    0    1    0    0    0
-BIAS/DESCRIPTION
*-------------------------------------------------------------------------------
+BIAS/SOLUTION
*BIAS SVN_ PRN STATION__ OBS1 OBS2 BIAS_START__ BIAS_END____ UNIT __ESTIMATED_VALUE____ _STD_DEV___ __ESTIMATED_SL
 ISB  G    G   GIEN      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GKIR      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GKOU      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GLPG      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GMAL      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GMIZ      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GNNO      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GNOR      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GOUS      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GTHT      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GUSN      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  G    G   GVES      C1W  C2W  11:113:86385 11:115:00285 ns   0.000000000000000E+00 .000000E+00
 ISB  E    E   GIEN      C1C  C7Q  11:113:86385 11:115:00285 ns   -.157174143960592E+03 .259286E+02
 ISB  E    E   GKIR      C1C  C7Q  11:113:86385 11:115:00285 ns   -.153942459345551E+03 .259286E+02
 ISB  E    E   GKOU      C1C  C7Q  11:113:86385 11:115:00285 ns   -.163243805130824E+03 .259285E+02
 ISB  E    E   GLPG      C1C  C7Q  11:113:86385 11:115:00285 ns   -.151698143836368E+03 .259290E+02
 ISB  E    E   GMAL      C1C  C7Q  11:113:86385 11:115:00285 ns   -.156472089904428E+03 .259285E+02
 ISB  E    E   GMIZ      C1C  C7Q  11:113:86385 11:115:00285 ns   -.167156432084244E+03 .259321E+02
 ISB  E    E   GNNO      C1C  C7Q  11:113:86385 11:115:00285 ns   -.156922861008147E+03 .259665E+02
 ISB  E    E   GNOR      C1C  C7Q  11:113:86385 11:115:00285 ns   -.153679440866705E+03 .259285E+02
 ISB  E    E   GOUS      C1C  C7Q  11:113:86385 11:115:00285 ns   -.101593337222667E+03 .259439E+02
 ISB  E    E   GTHT      C1C  C7Q  11:113:86385 11:115:00285 ns   -.159918985571303E+03 .259356E+02
 ISB  E    E   GUSN      C1C  C7Q  11:113:86385 11:115:00285 ns   -.149146613879327E+03 .259279E+02
 ISB  E    E   GVES      C1C  C7Q  11:113:86385 11:115:00285 ns   -.156221372596643E+03 .259288E+02
-BIAS/SOLUTION
*-------------------------------------------------------------------------------
%=ENDBIA
```

A.2 Example #1: GPS C1W–C1C DSB (or classic "P1–C1" DCB) product (extracted from CODE GPS clock analysis)

```
%=BIA 1.00 COD 15:279:73754 IGS 15:276:00000 15:276:86399 P 00032 2 SINEX_BIA
*-------------------------------------------------------------------------------
+FILE/REFERENCE
*INFO_TYPE_________ INFO________________________________________________________
 DESCRIPTION        CODE, Astronomical Institute, University of Bern
 OUTPUT             CODE GPS clock analysis
 CONTACT            code@aiub.unibe.ch
 SOFTWARE           Bernese GNSS Software Version 5.3
 HARDWARE           UBELIX: Linux, x86_64
 INPUT              IGS GPS/GLONASS tracking data
-FILE/REFERENCE
*-------------------------------------------------------------------------------
+BIAS/DESCRIPTION
*KEYWORD________________________________ VALUE(S)_______________________________
 OBSERVATION SAMPLING                                 300
 PARAMETER SPACING                                  86400
 DETERMINATION METHOD                    CLOCK ANALYSIS
 BIAS MODE                               DIFFERENTIAL
 TIME SYSTEM                             G
 REFERENCE SYSTEM                        G
 REFERENCE OBSERVABLES                   G   C1W  C2W
 ZERO-MEAN CONDITIONS                    G      1    0    1    0    0    0    0
-BIAS/DESCRIPTION
*-------------------------------------------------------------------------------
+BIAS/SOLUTION
*BIAS SVN_ PRN STATION__ OBS1 OBS2 BIAS_START__ BIAS_END____ UNIT __ESTIMATED_VALUE____ _STD_DEV___ __ESTIMATED_SL
 DSB  G063 G01           C1W  C1C  15:276:00000 15:276:86399 ns   0.136990291463586E+01 .495798E-02
 DSB  G061 G02           C1W  C1C  15:276:00000 15:276:86399 ns   -.116825398620806E+01 .521330E-02
 DSB  G069 G03           C1W  C1C  15:276:00000 15:276:86399 ns   0.154073114589892E+01 .498724E-02
 DSB  G034 G04           C1W  C1C  15:276:00000 15:276:86399 ns   0.553057343127956E+00 .495528E-02
 DSB  G050 G05           C1W  C1C  15:276:00000 15:276:86399 ns   0.150596519052711E+01 .516620E-02
 DSB  G067 G06           C1W  C1C  15:276:00000 15:276:86399 ns   0.182371144406284E+01 .525631E-02
 DSB  G048 G07           C1W  C1C  15:276:00000 15:276:86399 ns   0.918720233422413E+00 .500787E-02
 DSB  G072 G08           C1W  C1C  15:276:00000 15:276:86399 ns   0.494320991791880E-01 .495423E-02
 DSB  G068 G09           C1W  C1C  15:276:00000 15:276:86399 ns   0.158381203243076E+00 .505336E-02
 DSB  G036 G10           C1W  C1C  15:276:00000 15:276:86399 ns   0.127384795727486E+00 .380218E-01
 DSB  G046 G11           C1W  C1C  15:276:00000 15:276:86399 ns   -.186241742158861E+00 .503719E-02
 DSB  G058 G12           C1W  C1C  15:276:00000 15:276:86399 ns   0.822884097681954E+00 .512028E-02
 DSB  G043 G13           C1W  C1C  15:276:00000 15:276:86399 ns   0.747363413933297E+00 .510330E-02
 DSB  G041 G14           C1W  C1C  15:276:00000 15:276:86399 ns   -.501543087808895E+00 .505868E-02
 DSB  G055 G15           C1W  C1C  15:276:00000 15:276:86399 ns   0.139835207526154E+01 .517766E-02
 DSB  G056 G16           C1W  C1C  15:276:00000 15:276:86399 ns   -.119349048416255E+01 .504534E-02
 DSB  G053 G17           C1W  C1C  15:276:00000 15:276:86399 ns   0.939680694164286E+00 .516459E-02
 DSB  G054 G18           C1W  C1C  15:276:00000 15:276:86399 ns   -.938802084084508E+00 .502896E-02
 DSB  G059 G19           C1W  C1C  15:276:00000 15:276:86399 ns   -.233363668062039E+01 .496385E-02
 DSB  G051 G20           C1W  C1C  15:276:00000 15:276:86399 ns   -.193873007606566E+01 .516053E-02
 DSB  G045 G21           C1W  C1C  15:276:00000 15:276:86399 ns   -.130082602818353E+01 .497841E-02
 DSB  G047 G22           C1W  C1C  15:276:00000 15:276:86399 ns   -.261044253148914E+01 .492888E-02
 DSB  G060 G23           C1W  C1C  15:276:00000 15:276:86399 ns   -.961335267065625E-01 .495526E-02
 DSB  G065 G24           C1W  C1C  15:276:00000 15:276:86399 ns   0.135258580667365E+01 .519202E-02
 DSB  G062 G25           C1W  C1C  15:276:00000 15:276:86399 ns   -.541605529116360E+00 .509832E-02
 DSB  G071 G26           C1W  C1C  15:276:00000 15:276:86399 ns   0.235066050535949E+00 .506299E-02
 DSB  G066 G27           C1W  C1C  15:276:00000 15:276:86399 ns   -.581643847465688E-01 .496571E-02
 DSB  G044 G28           C1W  C1C  15:276:00000 15:276:86399 ns   -.899070827949663E+00 .501875E-02
 DSB  G057 G29           C1W  C1C  15:276:00000 15:276:86399 ns   0.137792299850169E+01 .503436E-02
 DSB  G064 G30           C1W  C1C  15:276:00000 15:276:86399 ns   -.368970377424869E+00 .502469E-02
 DSB  G052 G31           C1W  C1C  15:276:00000 15:276:86399 ns   0.857142063528477E+00 .507943E-02
 DSB  G023 G32           C1W  C1C  15:276:00000 15:276:86399 ns   -.164239288915549E+01 .492242E-02
-BIAS/SOLUTION
%=ENDBIA
```

A.3 Example #2: GPS/GLONASS C1W–C2W/C1P–C2P DSB product without consideration of GLONASS frequency channel dependence (extracted from CODE final ionosphere analysis)

```
%=BIA 1.00 COD 15:280:34714 IGS 15:276:00000 15:277:00000 P 00508 2 SINEX_BIA
*-------------------------------------------------------------------------------
+FILE/REFERENCE
*INFO_TYPE_________ INFO________________________________________________________
 DESCRIPTION        CODE, Astronomical Institute, University of Bern
```

```
 OUTPUT              CODE GPS/GLONASS ionosphere analysis
 CONTACT             code@aiub.unibe.ch
 SOFTWARE            Bernese GNSS Software Version 5.3
 HARDWARE            UBELIX: Linux, x86_64
 INPUT               IGS GPS/GLONASS tracking data
-FILE/REFERENCE
*-------------------------------------------------------------------------------
+BIAS/DESCRIPTION
*KEYWORD________________________________ VALUE(S)_______________________________
 OBSERVATION SAMPLING                            300
 PARAMETER SPACING                             86400
 DETERMINATION METHOD                   IONOSPHERE ANALYSIS
 BIAS MODE                              DIFFERENTIAL
 TIME SYSTEM                            G
 REFERENCE SYSTEM                       G
 OBSERVABLE GROUP                       G      4 @C2W C2W   C2L  C2S
 REFERENCE OBSERVABLES                  G  C1W  @C2W
 REFERENCE OBSERVABLES                  R  C1P  C2P
 ZERO-MEAN CONDITIONS                   G      1    0    1    0    0    0    0
 ZERO-MEAN CONDITIONS                   R      1    0    1    0    0    0    0
-BIAS/DESCRIPTION
*-------------------------------------------------------------------------------
+BIAS/SOLUTION
*BIAS SVN_ PRN STATION__ OBS1 OBS2 BIAS_START__ BIAS_END____ UNIT __ESTIMATED_VALUE____ _STD_DEV___ __ESTIMATED_SL
 DSB  G063 G01           C1W  @C2W 15:276:00000 15:277:00000 ns   -.789039492949038E+01 .118271E-01
 DSB  G061 G02           C1W  @C2W 15:276:00000 15:277:00000 ns   0.887061550167960E+01 .122794E-01
 DSB  G069 G03           C1W  @C2W 15:276:00000 15:277:00000 ns   -.541089919183528E+01 .117545E-01
 DSB  G034 G04           C1W  @C2W 15:276:00000 15:277:00000 ns   -.108884593577450E+00 .118100E-01
 DSB  G050 G05           C1W  @C2W 15:276:00000 15:277:00000 ns   0.275362757978975E+01 .123436E-01
 DSB  G067 G06           C1W  @C2W 15:276:00000 15:277:00000 ns   -.707081693666030E+01 .124487E-01
 DSB  G048 G07           C1W  @C2W 15:276:00000 15:277:00000 ns   0.292464612922085E+01 .115565E-01
 DSB  G072 G08           C1W  @C2W 15:276:00000 15:277:00000 ns   -.745662924479037E+01 .119303E-01
 DSB  G068 G09           C1W  @C2W 15:276:00000 15:277:00000 ns   -.495327694269251E+01 .117392E-01
 DSB  G036 G10           C1W  @C2W 15:276:00000 15:277:00000 ns   -.888528257979836E+00 .192074E-01
 DSB  G046 G11           C1W  @C2W 15:276:00000 15:277:00000 ns   0.340464289596011E+01 .121545E-01
 DSB  G058 G12           C1W  @C2W 15:276:00000 15:277:00000 ns   0.364033121022956E+01 .118473E-01
 DSB  G043 G13           C1W  @C2W 15:276:00000 15:277:00000 ns   0.292413413685829E+01 .119358E-01
 DSB  G041 G14           C1W  @C2W 15:276:00000 15:277:00000 ns   0.162840242789764E+01 .120212E-01
 DSB  G055 G15           C1W  @C2W 15:276:00000 15:277:00000 ns   0.249492760183708E+01 .121840E-01
 DSB  G056 G16           C1W  @C2W 15:276:00000 15:277:00000 ns   0.240340374274539E+01 .120922E-01
 DSB  G053 G17           C1W  @C2W 15:276:00000 15:277:00000 ns   0.270351860285290E+01 .121235E-01
 DSB  G054 G18           C1W  @C2W 15:276:00000 15:277:00000 ns   0.285024218198860E+01 .117488E-01
 DSB  G059 G19           C1W  @C2W 15:276:00000 15:277:00000 ns   0.549550724328732E+01 .120627E-01
 DSB  G051 G20           C1W  @C2W 15:276:00000 15:277:00000 ns   0.117014366089120E+01 .122423E-01
 DSB  G045 G21           C1W  @C2W 15:276:00000 15:277:00000 ns   0.298943332632011E+01 .115206E-01
 DSB  G047 G22           C1W  @C2W 15:276:00000 15:277:00000 ns   0.691641150841678E+01 .115310E-01
 DSB  G060 G23           C1W  @C2W 15:276:00000 15:277:00000 ns   0.876469896831230E+01 .115170E-01
 DSB  G065 G24           C1W  @C2W 15:276:00000 15:277:00000 ns   -.610716951658093E+01 .120496E-01
 DSB  G062 G25           C1W  @C2W 15:276:00000 15:277:00000 ns   -.784026353658018E+01 .119071E-01
 DSB  G071 G26           C1W  @C2W 15:276:00000 15:277:00000 ns   -.907364717669699E+01 .121135E-01
 DSB  G066 G27           C1W  @C2W 15:276:00000 15:277:00000 ns   -.545766718810367E+01 .118032E-01
 DSB  G044 G28           C1W  @C2W 15:276:00000 15:277:00000 ns   0.263259102321284E+01 .115887E-01
 DSB  G057 G29           C1W  @C2W 15:276:00000 15:277:00000 ns   0.225377118569203E+01 .117116E-01
 DSB  G064 G30           C1W  @C2W 15:276:00000 15:277:00000 ns   -.665485523246876E+01 .115986E-01
 DSB  G052 G31           C1W  @C2W 15:276:00000 15:277:00000 ns   0.422908095724109E+01 .121973E-01
 DSB  G023 G32           C1W  @C2W 15:276:00000 15:277:00000 ns   -.213709713697665E+01 .116207E-01
 DSB  R730 R01           C1P  C2P  15:276:00000 15:277:00000 ns   -.551776988937030E+01 .134457E-01
 DSB  R747 R02           C1P  C2P  15:276:00000 15:277:00000 ns   0.425064850267759E+00 .137247E-01
 DSB  R744 R03           C1P  C2P  15:276:00000 15:277:00000 ns   0.497794199921310E+01 .136506E-01
 DSB  R742 R04           C1P  C2P  15:276:00000 15:277:00000 ns   0.625925925347753E+01 .137853E-01
 DSB  R734 R05           C1P  C2P  15:276:00000 15:277:00000 ns   -.159883904022208E+00 .139329E-01
 DSB  R733 R06           C1P  C2P  15:276:00000 15:277:00000 ns   0.376110594864806E+01 .135932E-01
 DSB  R745 R07           C1P  C2P  15:276:00000 15:277:00000 ns   0.406030937864426E+01 .130779E-01
 DSB  R743 R08           C1P  C2P  15:276:00000 15:277:00000 ns   0.606853785896045E+01 .131535E-01
 DSB  R736 R09           C1P  C2P  15:276:00000 15:277:00000 ns   0.575317459315177E+01 .131028E-01
 DSB  R717 R10           C1P  C2P  15:276:00000 15:277:00000 ns   -.794818850572049E+01 .133943E-01
 DSB  R723 R11           C1P  C2P  15:276:00000 15:277:00000 ns   -.168416665324092E+01 .137075E-01
 DSB  R737 R12           C1P  C2P  15:276:00000 15:277:00000 ns   -.656917243149297E+01 .142588E-01
 DSB  R721 R13           C1P  C2P  15:276:00000 15:277:00000 ns   -.150054842761781E+01 .186409E-01
 DSB  R715 R14           C1P  C2P  15:276:00000 15:277:00000 ns   -.857776284981976E+01 .137275E-01
 DSB  R716 R15           C1P  C2P  15:276:00000 15:277:00000 ns   -.392195884292312E+01 .134734E-01
 DSB  R738 R16           C1P  C2P  15:276:00000 15:277:00000 ns   0.153370789642926E+00 .129558E-01
 DSB  R714 R17           C1P  C2P  15:276:00000 15:277:00000 ns   -.252002743913137E+01 .135530E-01
 DSB  R754 R18           C1P  C2P  15:276:00000 15:277:00000 ns   -.587478965234422E+00 .135548E-01
```

```
 DSB  R720 R19           C1P  C2P  15:276:00000 15:277:00000 ns   0.627082424153356E+01 .137012E-01
 DSB  R719 R20           C1P  C2P  15:276:00000 15:277:00000 ns   -.240728927404397E+01 .136027E-01
 DSB  R755 R21           C1P  C2P  15:276:00000 15:277:00000 ns   0.347652911801385E+01 .134491E-01
 DSB  R731 R22           C1P  C2P  15:276:00000 15:277:00000 ns   0.483689507813546E+00 .135081E-01
 DSB  R732 R23           C1P  C2P  15:276:00000 15:277:00000 ns   -.640142699680085E+01 .134619E-01
 DSB  R735 R24           C1P  C2P  15:276:00000 15:277:00000 ns   0.610586664005156E+01 .134957E-01
 DSB  G    G    ABMF     C1W  @C2W 15:276:00000 15:277:00000 ns   0.280529318307038E+02 .501257E-01
 DSB  R    R    ABMF     C1P  C2P  15:276:00000 15:277:00000 ns   0.401016267734374E+01 .545784E-01
 DSB  G    G    ABPO     C1W  @C2W 15:276:00000 15:277:00000 ns   -.687177661214301E+01 .532385E-01
 DSB  G    G    ADIS     C1W  @C2W 15:276:00000 15:277:00000 ns   -.137823411294387E+01 .567643E-01
 DSB  R    R    ADIS     C1P  C2P  15:276:00000 15:277:00000 ns   -.945298918660656E+01 .605325E-01
...
 DSB  G    G    ZWE2     C1W  @C2W 15:276:00000 15:277:00000 ns   0.132594960282132E+00 .377574E-01
-BIAS/SOLUTION
%=ENDBIA
```

A.4 Example #3: GPS/GLONASS DSB product (obtained from both clock and ionosphere analysis)

A.5 Example #4: GPS OSB product (obtained from both clock and ionosphere analysis)

A.6 Example #5: GPS/GLONASS OSB product (obtained from both both clock and ionosphere analysis)

A.7 Example #6: GPS/GLONASS ISB/DSB product with GLONASS ISB biases assumed to be frequency-channel-dependent parameters (extracted from CODE rapid clock analysis)

```
%=BIA 1.00 XYZ 15:277:57717 IGS 15:276:00000 15:276:86399 P 02282 2 SINEX_BIA
*-------------------------------------------------------------------------------
+FILE/REFERENCE
*INFO_TYPE_________ INFO________________________________________________________
 DESCRIPTION        CODE, Astronomical Institute, University of Bern
 OUTPUT             CODE's rapid GPS/GLONASS clock analysis
 CONTACT            code@aiub.unibe.ch
 SOFTWARE           Bernese GNSS Software Version 5.3
 HARDWARE           UBELIX: Linux, x86_64
 INPUT              IGS GPS/GLONASS tracking data
-FILE/REFERENCE
*-------------------------------------------------------------------------------
+BIAS/DESCRIPTION
*KEYWORD________________________________ VALUE(S)_______________________________
 OBSERVATION SAMPLING                            300
 PARAMETER SPACING                             86400
 DETERMINATION METHOD                   CLOCK ANALYSIS
 BIAS MODE                              DIFFERENTIAL
 TIME SYSTEM                            G
 REFERENCE SYSTEM                       G
 REFERENCE OBSERVABLES                  G  C1W  C2W
 REFERENCE OBSERVABLES                  R
 ZERO-MEAN CONDITIONS                   G     1    0    1    0    0    0    0
 ZERO-MEAN CONDITIONS                   R    24    0    0    0   24    0    0
-BIAS/DESCRIPTION
*-------------------------------------------------------------------------------
+BIAS/SOLUTION
*BIAS SVN_ PRN STATION__ OBS1 OBS2 BIAS_START__ BIAS_END____ UNIT __ESTIMATED_VALUE____ _STD_DEV___ __ESTIMATED_SL
 DSB  G063 G01           C1W  C1C  15:276:00000 15:276:86399 ns   0.138208389409961E+01 .328591E-03
 DSB  G061 G02           C1W  C1C  15:276:00000 15:276:86399 ns   -.116510308334292E+01 .328617E-03
```

DSB	G069	G03		C1W	C1C	15:276:00000	15:276:86399	ns	0.155838028414602E+01	.328625E-03
DSB	G034	G04		C1W	C1C	15:276:00000	15:276:86399	ns	0.539167118951049E+00	.328595E-03
DSB	G050	G05		C1W	C1C	15:276:00000	15:276:86399	ns	0.151083992433357E+01	.328636E-03
DSB	G067	G06		C1W	C1C	15:276:00000	15:276:86399	ns	0.178247305606531E+01	.328658E-03
DSB	G048	G07		C1W	C1C	15:276:00000	15:276:86399	ns	0.917045399649428E+00	.328576E-03
DSB	G072	G08		C1W	C1C	15:276:00000	15:276:86399	ns	0.152808734870094E-01	.328643E-03
DSB	G068	G09		C1W	C1C	15:276:00000	15:276:86399	ns	0.161250767477558E+00	.328602E-03
DSB	G036	G10		C1W	C1C	15:276:00000	15:276:86399	ns	0.879954087980935E-01	.329099E-03
DSB	G046	G11		C1W	C1C	15:276:00000	15:276:86399	ns	-.193036105715606E+00	.328623E-03
DSB	G058	G12		C1W	C1C	15:276:00000	15:276:86399	ns	0.854997095287675E+00	.328603E-03
DSB	G043	G13		C1W	C1C	15:276:00000	15:276:86399	ns	0.750950944857449E+00	.328620E-03
DSB	G041	G14		C1W	C1C	15:276:00000	15:276:86399	ns	-.514966798061877E+00	.328616E-03
DSB	G055	G15		C1W	C1C	15:276:00000	15:276:86399	ns	0.138797886619085E+01	.328627E-03
DSB	G056	G16		C1W	C1C	15:276:00000	15:276:86399	ns	-.120893134817916E+01	.328622E-03
DSB	G053	G17		C1W	C1C	15:276:00000	15:276:86399	ns	0.967914325902901E+00	.328621E-03
DSB	G054	G18		C1W	C1C	15:276:00000	15:276:86399	ns	-.934227712752738E+00	.328582E-03
DSB	G059	G19		C1W	C1C	15:276:00000	15:276:86399	ns	-.232028796479940E+01	.328612E-03
DSB	G051	G20		C1W	C1C	15:276:00000	15:276:86399	ns	-.192097177672341E+01	.328620E-03
DSB	G045	G21		C1W	C1C	15:276:00000	15:276:86399	ns	-.128711986362177E+01	.328572E-03
DSB	G047	G22		C1W	C1C	15:276:00000	15:276:86399	ns	-.265466300432933E+01	.328576E-03
DSB	G060	G23		C1W	C1C	15:276:00000	15:276:86399	ns	-.675749695928090E-01	.328589E-03
DSB	G065	G24		C1W	C1C	15:276:00000	15:276:86399	ns	0.134601738322875E+01	.328626E-03
DSB	G062	G25		C1W	C1C	15:276:00000	15:276:86399	ns	-.523147939254076E+00	.328611E-03
DSB	G071	G26		C1W	C1C	15:276:00000	15:276:86399	ns	0.216971709602869E+00	.328618E-03
DSB	G066	G27		C1W	C1C	15:276:00000	15:276:86399	ns	-.929483194382164E-01	.328609E-03
DSB	G044	G28		C1W	C1C	15:276:00000	15:276:86399	ns	-.873197568393859E+00	.328591E-03
DSB	G057	G29		C1W	C1C	15:276:00000	15:276:86399	ns	0.138979623722256E+01	.328593E-03
DSB	G064	G30		C1W	C1C	15:276:00000	15:276:86399	ns	-.331054224162791E+00	.328576E-03
DSB	G052	G31		C1W	C1C	15:276:00000	15:276:86399	ns	0.850216975578232E+00	.328626E-03
DSB	G023	G32		C1W	C1C	15:276:00000	15:276:86399	ns	-.163113661807498E+01	.328574E-03
ISB	G	G	ALBH	C1W	C2W	15:276:00000	15:276:86399	ns	0.000000000000000E+00	.000000E+00
ISB	R717	R10	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.150999666860230E+02	.558695E-01
ISB	R715	R14	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.150999666860230E+02	.558695E-01
ISB	R714	R17	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.117352048092906E+02	.828816E-01
ISB	R747	R02	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.130638694042271E+02	.636397E-01
ISB	R733	R06	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.130638694042271E+02	.636397E-01
ISB	R754	R18	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.141815227040625E+02	.570969E-01
ISB	R731	R22	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.141815227040625E+02	.570969E-01
ISB	R736	R09	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.160419500960109E+02	.575086E-01
ISB	R721	R13	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.160419500960109E+02	.575086E-01
ISB	R737	R12	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.155830165645740E+02	.542713E-01
ISB	R738	R16	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.155830165645740E+02	.542713E-01
ISB	R723	R11	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.162126260972474E+02	.559828E-01
ISB	R716	R15	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.162126260972474E+02	.559828E-01
ISB	R730	R01	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.151802936562642E+02	.545090E-01
ISB	R734	R05	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.151802936562642E+02	.545090E-01
ISB	R719	R20	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.131007420678933E+02	.546833E-01
ISB	R735	R24	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.131007420678933E+02	.546833E-01
ISB	R720	R19	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.120165531910436E+02	.535750E-01
ISB	R732	R23	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.120165531910436E+02	.535750E-01
ISB	R755	R21	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.110857561145634E+02	.788283E-01
ISB	R744	R03	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.109534969491898E+02	.554497E-01
ISB	R745	R07	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.109534969491898E+02	.554497E-01
ISB	R742	R04	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.121498476643008E+02	.527010E-01
ISB	R743	R08	ALBH	C1P	C2P	15:276:00000	15:276:86399	ns	-.121498476643008E+02	.527010E-01
ISB	G	G	ALGO	C1W	C2W	15:276:00000	15:276:86399	ns	0.000000000000000E+00	.000000E+00
ISB	R717	R10	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.193084086050889E+02	.550688E-01
ISB	R715	R14	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.193084086050889E+02	.550688E-01
ISB	R714	R17	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.269419882192354E+02	.797214E-01
ISB	R747	R02	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.345083821451689E+02	.575340E-01
ISB	R733	R06	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.345083821451689E+02	.575340E-01
ISB	R754	R18	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.399541337291144E+02	.545219E-01
ISB	R731	R22	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.399541337291144E+02	.545219E-01
ISB	R736	R09	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.412224693658342E+02	.605533E-01
ISB	R721	R13	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.412224693658342E+02	.605533E-01
ISB	R737	R12	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.448530539826817E+02	.569100E-01
ISB	R738	R16	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.448530539826817E+02	.569100E-01
ISB	R723	R11	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.488672838396323E+02	.558652E-01
ISB	R716	R15	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.488672838396323E+02	.558652E-01
ISB	R730	R01	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.552172987477151E+02	.583256E-01
ISB	R734	R05	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.552172987477151E+02	.583256E-01
ISB	R719	R20	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.590653576087313E+02	.572153E-01
ISB	R735	R24	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.590653576087313E+02	.572153E-01
ISB	R720	R19	ALGO	C1P	C2P	15:276:00000	15:276:86399	ns	0.665897424003241E+02	.596719E-01

```
 ISB  R732 R23 ALGO        C1P  C2P  15:276:00000 15:276:86399 ns    0.665897424003241E+02 .596719E-01
 ISB  R755 R21 ALGO        C1P  C2P  15:276:00000 15:276:86399 ns    0.653412206361103E+02 .787950E-01
 ISB  R744 R03 ALGO        C1P  C2P  15:276:00000 15:276:86399 ns    0.651827722448967E+02 .544648E-01
 ISB  R745 R07 ALGO        C1P  C2P  15:276:00000 15:276:86399 ns    0.651827722448967E+02 .544648E-01
 ISB  R742 R04 ALGO        C1P  C2P  15:276:00000 15:276:86399 ns    0.635121334604110E+02 .533628E-01
 ISB  R743 R08 ALGO        C1P  C2P  15:276:00000 15:276:86399 ns    0.635121334604110E+02 .533628E-01
 ISB  G    G   ALIC        C1W  C2W  15:276:00000 15:276:86399 ns    0.000000000000000E+00 .000000E+00
 ISB  R717 R10 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.430176913111677E+02 .705991E-01
 ISB  R715 R14 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.430176913111677E+02 .705991E-01
 ISB  R714 R17 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.457462497474025E+02 .106665E+00
 ISB  R747 R02 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.471192531666559E+02 .811568E-01
 ISB  R733 R06 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.471192531666559E+02 .811568E-01
 ISB  R754 R18 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.483802196365082E+02 .770150E-01
 ISB  R731 R22 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.483802196365082E+02 .770150E-01
 ISB  R736 R09 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.502402120064892E+02 .106030E+00
 ISB  R721 R13 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.502402120064892E+02 .106030E+00
 ISB  R737 R12 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.512678005097936E+02 .846019E-01
 ISB  R738 R16 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.512678005097936E+02 .846019E-01
 ISB  R723 R11 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.501067111090176E+02 .769388E-01
 ISB  R716 R15 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.501067111090176E+02 .769388E-01
 ISB  R730 R01 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.516734006694181E+02 .781776E-01
 ISB  R734 R05 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.516734006694181E+02 .781776E-01
 ISB  R719 R20 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.546266004176797E+02 .760129E-01
 ISB  R735 R24 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.546266004176797E+02 .760129E-01
 ISB  R720 R19 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.559590625949058E+02 .766997E-01
 ISB  R732 R23 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.559590625949058E+02 .766997E-01
 ISB  R755 R21 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.544352610108199E+02 .110008E+00
 ISB  R744 R03 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.543867319822968E+02 .746355E-01
 ISB  R745 R07 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.543867319822968E+02 .746355E-01
 ISB  R742 R04 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.520208878507874E+02 .737697E-01
 ISB  R743 R08 ALIC        C1P  C2P  15:276:00000 15:276:86399 ns    -.520208878507874E+02 .737697E-01
...
 ISB  G    G   ZECK        C1W  C2W  15:276:00000 15:276:86399 ns    0.000000000000000E+00 .000000E+00
 ISB  R717 R10 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.132880767273423E+02 .657057E-01
 ISB  R715 R14 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.132880767273423E+02 .657057E-01
 ISB  R714 R17 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.131236806897367E+02 .851828E-01
 ISB  R747 R02 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.912114045943647E+01 .574081E-01
 ISB  R733 R06 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.912114045943647E+01 .574081E-01
 ISB  R754 R18 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.100102541560107E+02 .571440E-01
 ISB  R731 R22 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.100102541560107E+02 .571440E-01
 ISB  R736 R09 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.862005234813679E+01 .610708E-01
 ISB  R721 R13 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.862005234813679E+01 .610708E-01
 ISB  R737 R12 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.153586249430593E+02 .557170E-01
 ISB  R738 R16 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.153586249430593E+02 .557170E-01
 ISB  R723 R11 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.998738498954875E+01 .619438E-01
 ISB  R716 R15 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.998738498954875E+01 .619438E-01
 ISB  R730 R01 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.986707410211821E+01 .619897E-01
 ISB  R734 R05 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.986707410211821E+01 .619897E-01
 ISB  R719 R20 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.141153412114568E+02 .628927E-01
 ISB  R735 R24 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.141153412114568E+02 .628927E-01
 ISB  R720 R19 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.129775788594078E+02 .613880E-01
 ISB  R732 R23 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.129775788594078E+02 .613880E-01
 ISB  R755 R21 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.127492762428632E+02 .830148E-01
 ISB  R744 R03 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.127109921890203E+02 .579514E-01
 ISB  R745 R07 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.127109921890203E+02 .579514E-01
 ISB  R742 R04 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.148705658908036E+02 .629627E-01
 ISB  R743 R08 ZECK        C1P  C2P  15:276:00000 15:276:86399 ns    0.148705658908036E+02 .629627E-01
-BIAS/SOLUTION
%=ENDBIA
```

A.8 Example #7: Five-GNSS (MGEX) ISB/DSB product (extracted from CODE MGEX clock analysis)

```
%=BIA 1.00 COM 15:280:36620 COM 15:276:00000 15:276:86399 P 01020 2 SINEX_BIA
*-------------------------------------------------------------------------------
* Bias Solution INdependent EXchange Format (Bias-SINEX)
*-------------------------------------------------------------------------------
+FILE/REFERENCE
*INFO_TYPE_________ INFO________________________________________________________
 REFERENCE FRAME    IGb08
 DESCRIPTION        Astronomical Institute, University of Bern
```

```
 OUTPUT              CODE MGEX bias estimates
 CONTACT             lars.prange@aiub.unibe.ch
 SOFTWARE            Bernese GNSS Software Version 5.3
 HARDWARE            UBELIX: Linux, x86_64
-FILE/REFERENCE
*-------------------------------------------------------------------------------
+SITE/ID
*CODE PT __DOMES__ T _STATION DESCRIPTION__ APPROX_LON_ APPROX_LAT_ _APP_H_
 ABMF  A 97103M001 P Les Abymes, FR         298 28 20.9  16 15 44.3   -25.6
 ADIS  A 31502M001 P Addis Ababa, ET         38 45 58.7   9  2  6.5  2439.2
 AIRA  A 21742S001 P Aira, JP               130 35 58.5  31 49 26.6   314.7
...
 ZIMJ  A 14001M006 P Zimmerwald, CH           7 27 54.4  46 52 37.7   954.3
-SITE/ID
*-------------------------------------------------------------------------------
+SITE/RECEIVER
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_________ S/N__ FIRMWARE___
 ABMF  A    1 P 15:274:00000 15:276:86399 LEICA GR25           ----- -----------
 ADIS  A    1 P 15:274:00000 15:276:86399 JPS LEGACY           ----- -----------
 AIRA  A    1 P 15:274:00000 15:276:86399 TRIMBLE NETR9        ----- -----------
...
 ZIMJ  A    1 P 15:274:00000 15:276:86399 JAVAD TRE_G3TH DELTA ----- -----------
-SITE/RECEIVER
*-------------------------------------------------------------------------------
+BIAS/DESCRIPTION
*KEYWORD________________________________ VALUE(S)_______________________________
 OBSERVATION SAMPLING                           300
 PARAMETER SPACING                            86400
 DETERMINATION METHOD                    CLOCK ANALYSIS
 BIAS MODE                               DIFFERENTIAL
 TIME SYSTEM                             G
 REFERENCE SYSTEM                        G
 REFERENCE OBSERVABLES                   C  C1I  C7I
 REFERENCE OBSERVABLES                   E  C1X  C5X
 REFERENCE OBSERVABLES                   G  C1W  C2W
 REFERENCE OBSERVABLES                   J  C1C  C2X
 REFERENCE OBSERVABLES                   R
 ZERO-MEAN CONDITIONS                    C     1    0    0    1    0    0    0
 ZERO-MEAN CONDITIONS                    E     1    0    0    1    0    0    0
 ZERO-MEAN CONDITIONS                    G     1    0    1    0    0    0    0
 ZERO-MEAN CONDITIONS                    J     1    0    0    1    0    0    0
 ZERO-MEAN CONDITIONS                    R    24    0    0    0   24    0    0
-BIAS/DESCRIPTION
*-------------------------------------------------------------------------------
+BIAS/SOLUTION
*BIAS SVN_ PRN STATION__ OBS1 OBS2 BIAS_START__ BIAS_END____ UNIT __ESTIMATED_VALUE____ _STD_DEV___ __ESTIMATED_SL
 DSB  G063 G01           C1W  C1C  15:276:00000 15:276:86399 ns   0.148022937908458E+01 .398201E-01
 DSB  G061 G02           C1W  C1C  15:276:00000 15:276:86399 ns   -.121015187124460E+01 .463167E-01
 DSB  G069 G03           C1W  C1C  15:276:00000 15:276:86399 ns   0.180949540435891E+01 .393379E-01
 DSB  G034 G04           C1W  C1C  15:276:00000 15:276:86399 ns   0.517194875813799E+00 .396322E-01
 DSB  G050 G05           C1W  C1C  15:276:00000 15:276:86399 ns   0.146614662451426E+01 .417000E-01
 DSB  G067 G06           C1W  C1C  15:276:00000 15:276:86399 ns   0.193325919748383E+01 .434123E-01
 DSB  G048 G07           C1W  C1C  15:276:00000 15:276:86399 ns   0.915764959372799E+00 .398921E-01
 DSB  G072 G08           C1W  C1C  15:276:00000 15:276:86399 ns   0.300369893926593E+00 .404106E-01
 DSB  G068 G09           C1W  C1C  15:276:00000 15:276:86399 ns   0.340687761191245E+00 .379686E-01
 DSB  G036 G10           C1W  C1C  15:276:00000 15:276:86399 ns   -.244736900754275E-01 .125984E+00
 DSB  G046 G11           C1W  C1C  15:276:00000 15:276:86399 ns   -.309495058713671E+00 .401170E-01
 DSB  G058 G12           C1W  C1C  15:276:00000 15:276:86399 ns   0.784816696565082E+00 .383424E-01
 DSB  G043 G13           C1W  C1C  15:276:00000 15:276:86399 ns   0.619253340128303E+00 .399141E-01
 DSB  G041 G14           C1W  C1C  15:276:00000 15:276:86399 ns   -.450072279494563E+00 .457811E-01
 DSB  G055 G15           C1W  C1C  15:276:00000 15:276:86399 ns   0.124573985255184E+01 .406018E-01
 DSB  G056 G16           C1W  C1C  15:276:00000 15:276:86399 ns   -.101459576857837E+01 .406213E-01
 DSB  G053 G17           C1W  C1C  15:276:00000 15:276:86399 ns   0.852378253981761E+00 .458405E-01
 DSB  G054 G18           C1W  C1C  15:276:00000 15:276:86399 ns   -.109492803922454E+01 .449504E-01
 DSB  G059 G19           C1W  C1C  15:276:00000 15:276:86399 ns   -.245661458982554E+01 .411123E-01
 DSB  G051 G20           C1W  C1C  15:276:00000 15:276:86399 ns   -.190964953076551E+01 .463188E-01
 DSB  G045 G21           C1W  C1C  15:276:00000 15:276:86399 ns   -.130650273147965E+01 .387007E-01
 DSB  G047 G22           C1W  C1C  15:276:00000 15:276:86399 ns   -.243328676096964E+01 .414811E-01
 DSB  G060 G23           C1W  C1C  15:276:00000 15:276:86399 ns   -.182148442925021E+00 .383014E-01
 DSB  G065 G24           C1W  C1C  15:276:00000 15:276:86399 ns   0.131860039763121E+01 .394932E-01
 DSB  G062 G25           C1W  C1C  15:276:00000 15:276:86399 ns   -.571982846645502E+00 .394793E-01
 DSB  G071 G26           C1W  C1C  15:276:00000 15:276:86399 ns   0.371100950909413E+00 .402464E-01
 DSB  G066 G27           C1W  C1C  15:276:00000 15:276:86399 ns   0.638346935977304E-01 .398397E-01
 DSB  G044 G28           C1W  C1C  15:276:00000 15:276:86399 ns   -.965854594064209E+00 .429742E-01
```

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 DSB  G057 G29            C1W  C1C  15:276:00000 15:276:86399 ns   0.129826128707329E+01 .379365E-01
 DSB  G064 G30            C1W  C1C  15:276:00000 15:276:86399 ns   -.461309363777909E+00 .383722E-01
 DSB  G052 G31            C1W  C1C  15:276:00000 15:276:86399 ns   0.813667651666248E+00 .433353E-01
 DSB  G023 G32            C1W  C1C  15:276:00000 15:276:86399 ns   -.173873565321104E+01 .379656E-01
 ISB  G    G    ABMF      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 ISB  C    C    ABMF      C1I  C7I  15:276:00000 15:276:86399 ns   0.240909461328850E+02 .835246E+00
 ISB  E    E    ABMF      C1X  C5X  15:276:00000 15:276:86399 ns   0.283943462310280E+02 .837023E+00
 ISB  G    G    AIRA      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 ISB  J    J    AIRA      C1C  C2X  15:276:00000 15:276:86399 ns   0.339467838586768E+01 .844428E+00
 ISB  G    G    AJAC      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 ISB  C    C    AJAC      C1I  C7I  15:276:00000 15:276:86399 ns   0.227493815869896E+02 .684065E+00
...
 ISB  G    G    CAS1      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 ISB  C    C    CAS1      C1I  C7I  15:276:00000 15:276:86399 ns   -.449508864157964E+01 .139643E+00
 ISB  E    E    CAS1      C1X  C5X  15:276:00000 15:276:86399 ns   0.140919876433476E+02 .249790E+00
 ISB  J    J    CAS1      C1C  C2X  15:276:00000 15:276:86399 ns   -.302029287476200E+01 .805993E+00
...
 ISB  G    G    ZIMJ      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 ISB  E    E    ZIMJ      C1X  C5X  15:276:00000 15:276:86399 ns   -.157405972813336E+02 .221344E+01
 ISB  G    G    AUCK      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 ISB  R730 R01  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.104868834341878E+02 .101419E+01
 ISB  R747 R02  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.839102657967896E+01 .815723E+00
 ISB  R744 R03  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.135359520616739E+02 .773238E+00
 ISB  R742 R04  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.134158942739078E+02 .129927E+01
 ISB  R734 R05  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.837243105595812E+01 .132295E+01
 ISB  R733 R06  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.820421636703761E+01 .954566E+00
 ISB  R745 R07  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.135968774946661E+02 .903589E+00
 ISB  R743 R08  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.138457954908824E+02 .100113E+01
 ISB  R736 R09  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.790492775187953E+01 .104148E+01
 ISB  R717 R10  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.524778105245740E+01 .134141E+01
 ISB  R723 R11  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.948578261467121E+01 .130657E+01
 ISB  R737 R12  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.972770928266179E+01 .909708E+00
 ISB  R721 R13  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.373032097478001E+01 .859959E+00
 ISB  R715 R14  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.674389168967504E+01 .985594E+00
 ISB  R716 R15  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.786586700362409E+01 .936358E+00
 ISB  R738 R16  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.866978813764577E+01 .869350E+00
 ISB  R714 R17  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.732214133503972E+01 .101006E+01
 ISB  R754 R18  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.757264066247209E+01 .863350E+00
 ISB  R720 R19  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.121460448576070E+02 .970700E+00
 ISB  R719 R20  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.111976195235630E+02 .103509E+01
 ISB  R755 R21  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.120314836510983E+02 .929166E+00
 ISB  R731 R22  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.111481315850749E+02 .884697E+00
 ISB  R732 R23  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.129333545039342E+02 .999431E+00
 ISB  R735 R24  AUCK      C1P  C2P  15:276:00000 15:276:86399 ns   0.105168215138981E+02 .110471E+01
 ISB  G    G    CAS1      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 ISB  R730 R01  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.142962087888634E+02 .538876E+00
 ISB  R747 R02  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.141428673312890E+02 .492828E+00
 ISB  R744 R03  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.144563866144409E+02 .489244E+00
 ISB  R742 R04  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.150524868063027E+02 .514893E+00
 ISB  R734 R05  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.148943556420188E+02 .535208E+00
 ISB  R733 R06  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.141091386524846E+02 .538231E+00
 ISB  R745 R07  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.150205576220032E+02 .588531E+00
 ISB  R743 R08  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.154528418397519E+02 .642259E+00
 ISB  R736 R09  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.155183816327803E+02 .624480E+00
 ISB  R717 R10  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.152895561383006E+02 .627324E+00
 ISB  R723 R11  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.138757885921803E+02 .546936E+00
 ISB  R737 R12  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.143352972342411E+02 .525732E+00
 ISB  R721 R13  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.193323182417826E+02 .656144E+00
 ISB  R715 R14  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.145005385943018E+02 .541529E+00
 ISB  R716 R15  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.155035695298621E+02 .480324E+00
 ISB  R738 R16  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.155009899627115E+02 .507940E+00
 ISB  R714 R17  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.131396020174200E+02 .551930E+00
 ISB  R754 R18  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.144292271009203E+02 .505692E+00
 ISB  R720 R19  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.141801404751045E+02 .573356E+00
 ISB  R719 R20  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.145505046410718E+02 .525193E+00
 ISB  R755 R21  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.149012826015975E+02 .496307E+00
 ISB  R731 R22  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.130037079969488E+02 .531747E+00
 ISB  R732 R23  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.138784061156290E+02 .605166E+00
 ISB  R735 R24  CAS1      C1P  C2P  15:276:00000 15:276:86399 ns   -.143839030856901E+02 .602370E+00
 ISB  G    G    CEDU      C1W  C2W  15:276:00000 15:276:86399 ns   0.000000000000000E+00 .000000E+00
 ISB  R730 R01  CEDU      C1P  C2P  15:276:00000 15:276:86399 ns   0.193893827924167E+02 .135805E+01
 ISB  R747 R02  CEDU      C1P  C2P  15:276:00000 15:276:86399 ns   0.192126665393477E+02 .152156E+01
 ISB  R744 R03  CEDU      C1P  C2P  15:276:00000 15:276:86399 ns   0.271950610593115E+02 .127412E+01
 ISB  R742 R04  CEDU      C1P  C2P  15:276:00000 15:276:86399 ns   0.297828161792865E+02 .128979E+01
```

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 ISB   R734 R05  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.244315077458299E+02 .159370E+01
 ISB   R733 R06  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.188607477704492E+02 .248283E+01
 ISB   R745 R07  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.264919290069864E+02 .219594E+01
 ISB   R743 R08  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.288620506273102E+02 .153441E+01
 ISB   R736 R09  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.284471247343819E+02 .155226E+01
 ISB   R717 R10  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.309788159487919E+02 .139899E+01
 ISB   R723 R11  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.213263836510131E+02 .157847E+01
 ISB   R737 R12  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.199178858524953E+02 .232573E+01
 ISB   R721 R13  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.180503616769590E+02 .146855E+01
 ISB   R715 R14  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.282720316225087E+02 .124099E+01
 ISB   R716 R15  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.227191646822520E+02 .154990E+01
 ISB   R738 R16  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.183776066139295E+02 .178722E+01
 ISB   R714 R17  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.217932617651448E+02 .144117E+01
 ISB   R754 R18  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.201501264861387E+02 .175320E+01
 ISB   R720 R19  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.276394548613151E+02 .149600E+01
 ISB   R719 R20  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.323391442761390E+02 .136349E+01
 ISB   R755 R21  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.254892461514935E+02 .155014E+01
 ISB   R731 R22  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.166707246486941E+02 .181508E+01
 ISB   R732 R23  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.208479557474807E+02 .155389E+01
 ISB   R735 R24  CEDU       C1P   C2P   15:276:00000 15:276:86399 ns    0.302532995431493E+02 .139198E+01
...
 ISB   G    G    ZIMJ       C1W   C2W   15:276:00000 15:276:86399 ns    0.000000000000000E+00 .000000E+00
 ISB   R730 R01  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.972885605391789E+01 .538791E+01
 ISB   R747 R02  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.439564578686457E+01 .431303E+01
 ISB   R744 R03  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.143070861993473E+02 .416080E+01
 ISB   R742 R04  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.167308698561809E+02 .436484E+01
 ISB   R734 R05  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.936495668212227E+01 .429330E+01
 ISB   R733 R06  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.294782709523497E+01 .382497E+01
 ISB   R745 R07  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.136642787424810E+02 .390642E+01
 ISB   R743 R08  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.162814262174600E+02 .630349E+01
 ISB   R736 R09  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.417520880953636E+01 .343112E+01
 ISB   R717 R10  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    -.197295041048047E+00 .433052E+01
 ISB   R723 R11  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.964335178943640E+01 .417314E+01
 ISB   R737 R12  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.835381166884288E+01 .450339E+01
 ISB   R721 R13  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.213722136254250E+01 .570818E+01
 ISB   R715 R14  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.469333584577121E+01 .651020E+01
 ISB   R716 R15  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.933410657672710E+01 .535240E+01
 ISB   R738 R16  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.150472801010011E+02 .363863E+01
 ISB   R714 R17  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.914230043919777E+00 .504956E+01
 ISB   R754 R18  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.571084663887050E+01 .433465E+01
 ISB   R720 R19  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.131271657640214E+02 .493972E+01
 ISB   R719 R20  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.136544036815614E+02 .483610E+01
 ISB   R755 R21  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.136580739546778E+02 .428415E+01
 ISB   R731 R22  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.547618852828835E+01 .418279E+01
 ISB   R732 R23  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.125084282479058E+02 .441406E+01
 ISB   R735 R24  ZIMJ       C1P   C2P   15:276:00000 15:276:86399 ns    0.134921160156186E+02 .438454E+01
-BIAS/SOLUTION
%=ENDBIA
```

A.9 Example #8: Five-GNSS (MGEX) OSB product (obtained from both clock and ionosphere analysis)

Appendix B An Excerpt From SINEX (2.02) Format Descriptions

Appendix B contains an excerpt from the SINEX (2.02) format descriptions in order to complete this document for a reader who is not familiar with SINEX.

B.1 INTRODUCTION

The SINEX acronym was suggested by Blewitt et al. (1994) and the first versions, 0.04, 0.05, 1.00 evolved from the work and contributions of the SINEX Working Group of the IGS. The IGS Analysis Centres and Associated Analysis Centres use the SINEX format for their weekly solutions since mid 1995. Although the SINEX format was developed by the IGS, the ILRS and IVS decided to use it for their pilot projects as well because SINEX was designed to be modular and general enough to handle GPS as well as other techniques. To meet all the requirements for SLR and VLBI solutions some new elements and more detailed specifications were added by the ILRS Analysis Working Group and by the IVS. These extensions were merged with the previous SINEX version 1.00 to get a unique format definition for all space geodetic techniques, and after an intensive discussion the new version called SINEX 2.00 could be finalized. We have to thank the IGS Reference Frame Working Group chaired by R. Ferland, the ILRS Analysis Coordinator R. Noomen and the ILRS Analysis Working Group, the IVS Analysis Coordinator A. Nothnagel and Z. Altamimi from the ITRF section of IGN for their contributions and advice concerning a new SINEX format definition. The changes from version 1.00 to 2.00 are given in the next section of this document. The complete and detailed format definition can be seen in APPENDIX I, and the relevant least squares adjustment formulas with their relations to the SINEX format are summarized in APPENDIX II.

B.2 SINEX SYNTAX

SINEX is an ASCII file with lines of 80 chars or less. It consists of a number of blocks which are mutually referenced (related) through station codes/names, epochs and/or index counters. Some blocks consist of descriptive lines (starting in Col.2) and/or fixed format fields with numerous headers and descriptive annotations.

The first line is MANDATORY and must start with "%" in col 1, and contains information about the agency, file identification, solution spans, techniques, type of solution, etc. (for more details see the Appendix I or II). The last line ends with "%ENDSNX".

The SINEX format consists of a number BLOCKS which start with "+" in the first col. followed by a standardized block labels, and each block ends with "-" and the block label. Each block data starts in the column 2 or higher. Blocks can be in any order, provided that they start with (+) and end with (-) block labels. The first header line and most blocks are related through epochs or time stamps in the following format: YY:DOY:SECOD YY-year; DOY- day of year; SECOD -sec of day; E.g. the epoch 95:120:86399 denotes April 30, 1995 (23:59:59UT). The epochs 00:00:00000 are allowed in all blocks, except the first header line if the SINEX file is an output of a data analysis (in case of a SINEX template the epoch 00:00:00000 is allowed in the header line as well) and default into the start or end epochs of the first header line which must always be coded. This is particularly useful for some blocks, such as the ones related to hardware, occupancy, which should be centrally archived by IGSCB with 00:00:00000 as the end (current) epochs, and which should be readily usable by ACs for SINEX and other analysis/processing as official (authoritative) IGS information.

COMMENT lines starts with "*" in Col. 1 and can be anywhere within or outside a block, though for the clarity sake, beginning and ends of blocks are preferable. For increased portability, the floating number exponent of "E" should be used rather than "D" or "d" which is not recognized by some compiler/installations. Fields not coded should be filled with "-" characters to allow efficient row and column format readings.

B.3 SINEX VERSION 2.00—DETAIL FORMAT DESCRIPTION

B.3.1 1. Introduction

```
This document describes the Software Independent Exchange (SINEX) format. It
started in early 1995 with an effort by a number of IGS participants and it was
designed to be easily extended. For the new IERS structure, operational since
January 1, 2001, and due to the use of SINEX by the ILRS (pilot project
'positioning and earth orientation') and the IVS as well, some extensions were
made with the purpose to have a unique format description for all techniques.
```

B.3.2 2. Data Structure

```
Each SINEX line has at most 80 ASCII characters.
The SINEX file is subdivided in groups of data called blocks. Each block is
enclosed by a header and trailer line. Each block has a fixed format. The
blocks contain information on the file, its input, the sites and the solution.
All elements within a line are defined. A character field without information will
have "-"s within its field and a missing numerical element will have a value of 0
within its field. Therefore the SINEX file is accessible "column-wise" as well as
"line-wise". Character fields should be left hand justified whenever applicable.

The first character of each line identifies the type of information that the
line contains. Five characters are reserved. They have the following
meaning when they are at the beginning of a line, they identify:
Character Definition
"%" Header and trailer line,
"*" Comment line within the header and trailer line,
"+" Title at the start of a block
"-" Title at the end of a block
" " Data line within a block

No other character is allowed at the beginning of a line!

A SINEX file must start with a header line and ends with a footer line.

The following blocks are defined:

FILE/REFERENCE
FILE/COMMENT
INPUT/HISTORY
```

```
INPUT/FILES
INPUT/ACKNOWLEDGMENTS
NUTATION/DATA
PRECESSION/DATA
SOURCE/ID
SITE/ID
SITE/DATA
SITE/RECEIVER
SITE/ANTENNA
SITE/GPS_PHASE_CENTER
SITE/GAL_PHASE_CENTER
SITE/ECCENTRICITY
SATELLITE/ID
SATELLITE/PHASE_CENTER
BIAS/EPOCHS
SOLUTION/EPOCHS
SOLUTION/STATISTICS
SOLUTION/ESTIMATE
SOLUTION/APRIORI
SOLUTION/MATRIX_ESTIMATE {p} {type}
SOLUTION/MATRIX_APRIORI {p} {type}
SOLUTION/NORMAL_EQUATION_VECTOR
SOLUTION/NORMAL_EQUATION_MATRIX {p}

        Where:  {p}     L or U
                {type}  CORR or COVA or INFO
```

These block titles are immediately preceded by a "+" or a "-" as they mark the beginning or the end of a block. The block titles must be in capital letters. After a block has started(+) it must be ended(-) before another block can begin. The general structure is as follows:

```
%=SNX........... (Header line)----------|
.............                           |
+(BLOCK TITLE)-------------|            |
 ...........               |            |
 ...........               |            |
 ...........               |            |
-(BLOCK TITLE)-------------|            |
.............                           |
+(BLOCK TITLE)-------------|            |
 ...........               |            |
 ...........               |            |
 ...........               |            |
-(BLOCK TITLE)------------ |            |
.............                           |
%ENDSNX          (Trailer line)---------|
```

Most fields within a SINEX line are separated by a single space. In the following sections, each SINEX line is defined by its field name, a general description and the (FORTRAN) format.

A comment line (not to be confused with the FILE/COMMENT Block) can be written anywhere within the header and the footer line. All comment lines must start with a "*" in the first column. With the use of this character information can be hidden from the software reading the file without deleting it from the file. A comment line is defined as follows:

```
 ------------------------------------------------------------------
|_____________________C_O_M_M_E_N_T___D_A_T_A___L_I_N_E____________|
|                |                                   |              |
|__Field_________|______Description__________________|___Format_____|
|                |                                   |              |
| Comment        | Any general comment relevant to   |   1H*,A79    |
|                | the SINEX file.                   |              |
|________________|___________________________________|______________|
                                                     |              |
                                                     |      80      |
                                                     |______________|
```

Some fields are found in several blocks. To keep the description short, they are described in detail here, and will be referred to in the sections with additional information added when necessary. The fields defined below will be referenced to by putting them within square brackets [] when encountered in the following sections.

Field	Description	Format
Time	YY:DDD:SSSSS. "UTC" YY = last 2 digits of the year, if YY <= 50 implies 21-st century, if YY > 50 implies 20-th century, DDD = 3-digit day in year, SSSSS = 5-digit seconds in day.	I2.2, 1H:,I3.3, 1H:,I5.5
Constraint Code	Single digit indicating the constraints: 0-fixed/tight constraints, 1-significant constraints, 2-unconstrained.	A1

B.3.3 4. FILE/REFERENCE Block (Mandatory)

Description:

This block provides information on the Organization, point of contact, the software and hardware involved in the creation of the file.

Contents:

FILE REFERENCE DATA LINE		
Field	Description	Format
Information Type	Describes the type of information present in the next field. May take on the following values: 'DESCRIPTION' - Organization(s) gathering/altering the file contents. 'OUTPUT' - Description of the file contents. 'CONTACT' - Address of the relevant contact. e-mail 'SOFTWARE' - Software used to generate the file. 'HARDWARE' - Computer hardware on which above software was run. 'INPUT' - Brief description of the input used to generate this solution. Any of the above fields may be and in any order.	1X,A18
Information	Relevant information for the type indicated by the previous field.	1X,A60
		80

B.3.4 5. FILE/COMMENT Block (Optional)

Description:

This block can be used to provide general comments about the SINEX data file.

Contents:

FILE COMMENT DATA LINE		
Field	Description	Format
Comment	Any general comment providing relevant information about the SINEX file.	1X,A79
		80

B.3.5 12. SITE/ID Block (Mandatory)

Description:

This block provides general information for each site containing estimated parameters.

Contents:

SITE ID DATA LINE		
Field	Description	Format
[Site Code]	Call sign for a site.	1X,A4
[Point Code]	Physical monument used at a site	1X,A2
Unique Monument Identification	Unique alpha-numeric monument identification. For ITRF purposes, it is a nine character DOMES/DOMEX number (five/six digits, followed by the single letter 'M' or 'S', followed by four/three digits)	1X,A9
[Observation Code]	Observation technique(s) used.	1X,A1
Station Description	Free-format description of the site, typically the town and/or country.	1X,A22
Approximate Longitude	Approximate longitude of the site in degrees(E/+), minutes and seconds.	1X,I3, 1X,I2, 1X,F4.1
Approximate Latitude	Approximate latitude of the site in degrees(NS/+-), minutes and seconds.	1X,I3, 1X,I2, 1X,F4.1
Approximate Height	Approximate height of the site in metres.	1X,F7.1
		75

Comments:

For DOMES numbers and station description as well as for Site Codes please

refer to
  ftp://lareg.ensg.ign.fr/pub/itrf/iers_dir.sta

If a DOMES number is not available (e.g. for a new station), please ask Zuheir Altamimi for a DOMES number (altamimi@ensg.ign.fr).

Use the minus sign for negative approximate longitude or latitude only in the "degrees" component and don't repeat it in the "minutes" and "seconds" component.

Following the ISO6709 specification, the range of longitude should be
[-180 +180 [.

B.3.6 14. SITE/RECEIVER Block (Mandatory for GPS)

Description:

List the receiver used at each site during the observation period of interest.

Contents:

SITE RECEIVER DATA LINE

Field	Description	Format
[Site Code]	Site code for which some parameters are estimated.	1X,A4
[Point Code]	Point Code at a site for which some parameters are estimated.	1X,A2
[Solution ID]	Solution Number at a Site/Point code for which some parameters are estimated.	1X,A4
[Observation Code]	Identification of the observation technique used.	1X,A1
[Time]	Time since the receiver has been operating at the Site/Point. Value 00:000:00000 indicates that the receiver has been operating at least since the "File Epoch Start Time".	1X,I2.2, 1H:,I3.3, 1H:,I5.5
[Time]	Time until the receiver is operated at a Site/Point. Value 00:000:00000 indicates that the receiver has been operating at least until the "File Epoch End Time".	1X,I2.2, 1H:,I3.3, 1H:,I5.5
Receiver Type	Receiver Name & model.	1X,A20
Receiver Serial Number	Serial number of the receiver. Takes on value '-----' if unknown.	1X,A5
Receiver Firmware	Firmware used by this receiver during the epoch specified above. Takes on value '-----------' if unknown.	1X,A11

```
                                                             |     80       |
                                                             |______________|
Comments:

- For IGS standard receiver names please refer to
  ftp://igscb.jpl.nasa.gov/igscb/station/general/rcvr_ant.tab
```