# Clock Data (CLK file)

## Summary

Geoscience Australia's (GA) Ginan Analysis Centre Software (ACS) calculates GNSS satellite orbit and clock data based on the GNSS observables captured by both GA's continuously operating reference station (CORS) network covering Australia, New Zealand and the South Pacific and a network of international stations. The clock data is available from GA in the RINEX (Receiver Independent Exchange) CLK file format.

CLK is an abbreviation of clock and is technically an extension to the RINEX standard to include clock data. The RINEX standard was first developed by W. Gurtner in 1989 [1] and the extension to clock data was first released in 1998 [2]. Since then, it has been expanded and improved upon, and now holds data on satellites from all the GNSS constellations and augmentation services.

Currently, data in Ginan CLK files only provide information on the clock offset for GPS satellites. These files can be used in conjunction with the precise orbital position (ephemerides) of the satellites provided by our SP3 file. These products, when post processed with GNSS observation data can increase the accuracy of derived position data.

The RINEX extension for clock data document which details the allowed data types, file format and contents is available from the IGS Formats and Standards page:
https://files.igs.org/pub/data/format/rinex_clock304.txt

## Access

Geoscience Australia offers clock data in the form of a CLK file [1].

Users can freely access these files at https://data.gnss.ga.gov.au/docs/home/index.html with documentation on how to obtain them at
https://geoscienceaustralia.github.io/ginan/resources/GinanProductsStreamsAccess20220422.pdf
Methods include sftp and AWS s3.

## Technical details

| Positioning Australia CLK Clock Products | |
|---|---|
| **Versions** | Rapid |
| **Products Released** | One Rapid Product daily |
| **Release Times** | Rapid: 1700 UTC |
| **Constellations Covered** | GPS (in future will include Galileo, GLONASS, BeiDou and QZSS) |
| **Data Source** | RINEX format Phase and Pseudorange observations from a globally distributed network of GNSS receivers soured from Geoscience Australia's CORS |

| | |
|---|---|
| | stations and others from the International GNSS Service (IGS) network [3].<br><br>Earth orientation data from the International Earth Rotation and Reference Systems service's (IERS) daily final values [4]. |
| **Filenames** | The CLK products follow the IGS Long Product Filename convention, detailed in this document:<br><br>http://acc.igs.org/repro3/Long_Product_Filenames_v1.0.pdf<br><br>An example of a filename is given below:<br><br>GAG0OPSRAP_20231590000_01D_30S_CLK.CLK<br><br>Use the table below for a break-down of this filename: |

| GAG0OPSRAP_20231590000_01D_30S_CLK.CLK | | |
|---|---|---|
| **Code** | **Meaning** | **Value** |
| GAG | Analysis Centre | Geoscience Australia Ginan |
| 0 | Version Number | Version 0 |
| OPS | Campaign Type | Operational |
| RAP | Solution Type | Rapid (ULT: Ultra-Rapid, FIN: Final) |
| 20221590000 | Datetime of Initial Epoch YYYYDOYHHmm | Year: 2023, Day-of-year: 159, Time: 0000 UTC |
| 01D | Length from Initial Epoch in File D-Day, H-Hour, M-Minute, S-Second | 1 Day (24 hours) |
| 30S | Epoch Length – Amount of Time between each record | 30 Seconds |
| CLK | File / Product Type | Clock |
| .CLK | File Extension | CLK file |

## File Specification History

CLK is an abbreviation for "clock" and is technically an extension to the RINEX standard to include clock data. The RINEX standard was first developed by W. Gurtner in 1989 [1] and the extension to include clock data was first released in 1998 [2].

The file specification has expanded since 1998 and contains various forms of data. In 2017 version 3.04 of the *"RINEX Extensions to Handle Clock Information"* specification was released. This format supports:

- Observational data:
  - Calibrations (CR) or measurements on the time delay between a receiver and some external reference clock
  - Discontinuities (DR) or measurements to indicate when a receiver's internal clock is reset
- Analysis data for:
  - Receiver clocks (AR) i.e. results for a given receiver from the analysis of a network of receivers and satellites with respect to a reference clock
  - Satellite clocks (AS) i.e. results for a given satellite from the analysis of a network of receivers and satellites with respect to a reference clock
    - This AS data is the only one provided in the Ginan CLK file at the moment.
- Broadcast clock data (MS) for monitoring purposes comparing the broadcast values of satellite clocks to a laboratory standard

Many other details are included within these files, such as the time system used, the standard or fixed clock to which the results are referenced, constellations covered, leap second information and other crucial factors which make results across different files comparable.

For more information on the CLK format please refer to [2]. For more information on the history of the SP format please refer to [1] and [2].

## Quality Assurance

On a daily basis GA assesses the quality of the precise orbit and clock data by comparison with other independent sources. For further details on quality monitoring please contact GA at clientservices@ga.gov.au.

## Terms of Use

GA provides clock data in CLK format free of charge but on an "as is" and "with all faults" basis without any warranty whatsoever. GA does not warrant that the clock data shall meet any requirements or expectations or be fit for any intended purposes.

GA assumes no responsibility for errors or omissions in the contents of the Service and reserves the right to make additions, deletions, or modification to the contents on the Service at any time without prior notice.

GA does not guarantee the accuracy, relevance, timeliness, or completeness of any information or data available through the Service or on linked external websites.

## References

[1] Teunissen, Peter; Montenbruck, Oliver (2017). Springer Handbook of Global Navigation Satellite Systems. Springer. p. 1209. ISBN 9783319429281.

[2] https://files.igs.org/pub/data/format/rinex_clock304.txt

[3] https://igs.org/network/

[4] https://datacenter.iers.org/data/latestVersion/finals.daily.iau2000.txt