GLONASS TIME AND UTC(SU)

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GLONASS TIME AND UTC(SU)

Global Navigation Satellite System GLONASS is used for high-accuracy determination of position, motion velocity and time by land, marine, air and other kinds of users.

To achieve this the time scales (TS) of all Space Vehicles (SV) are synchronized relative to System Time Scale (STS) and STS is synchronized to the Reference Time Scale (RTS).

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GLONASS-Time Generation

GLONASS-time is generated as a continuous "paper" TS on the base of the Central Synchronizer (CS) TS using the following equation:

$$\Delta T_{STS}(t) = \Delta T(t) - \Delta T^{syst}(t - t_0) + \Delta T^{ph}(t_i) + \Delta T^{fr}(t_j)$$

where – GLONASS STS offset relative to RTS;

$\Delta T(t)$ – CS TS offset relative to RTS;

$\Delta T^{syst}(t)$ – compensated systematic component of CS TS offset;

$\Delta T^{syst}(t - t_{0f})$ – corrections for CS phase steering;

$\Delta T^{ph}(t_i)$ – corrections for CS frequency steering.

$\Delta T^{fr}(t_j)$

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GLONASS-Time Generation

The Universal Time Coordinated of Russia UTC(SU) generated by State Time/Frequency Reference (STFR) is used as RTS.

According to the Interface Control Document, the GLONASS-time offset relative to UTC(SU) should not exceed 1 ms. At present, this offset is about 380 ns.

There is no whole second time offset between GLONASS-time and UTC(SU) because GLONASS-time is corrected simultaneously with the corrections of UTC.

However, there is a 3-hour constant offset between GLONASS-time and UTC(SU) due to the Terrestrial Control Complex operational principles.

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GLONASS-Time Synchronization to UTC(SU)

CS TS offset relative to STFR TS is determined by simultaneous measuring the CS TS and STFR TS offsets relative to GLONASS-time and GPS-time and their joint processing according to the following equation:

$$\Delta T_{STFR-CS} = \Delta T_{GL(GPS)-CS} - \Delta T_{GL(GPS)-STFR}$$

where $\Delta T_{STFR-CS}$ – CS TS offset relative to STFR TS;

– $\Delta T_{GL(GPS)-CS}$ CS TS offset relative to GLONASS/GPS-time;

– $\Delta T_{GL(GPS)-STFR}$ STFR TS offset relative to GLONASS/GPS-time.

At present the error of determining an offset between main CS TS and STFR TS is about 8 ns (rms) using GLONASS signals and about 3 ns (rms) using GPS signals.

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GLONASS-Time Synchronization to UTC(SU)

Time/frequency corrections for GLONASS-time offset relative to UTC(SU) are broadcast in navigation messages.

The random error component of broadcast corrections for GLONASS STS offset relative to UTC(SU) does not exceed 10 ns.

Thank you for your attention!