



Global Navigation Satellite System

This chapter describes the Global Navigation Satellite System (GNSS) NCS-55A2-MOD-SE-S Line Card. This chapter also describes the procedures used to configure the GNSS port.

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Configuring the Global Navigation Satellite System

In typical telecom networks, synchronization works in a hierarchal manner where the core network is connected to a stratum-1 clock. The stratum-1 clock is then distributed along the network in a tree-like structure. However, with a GNSS receiver, clocking is changed to a flat architecture, where access networks can directly take clock from satellites in sky by using an on-board GPS chip.

IOS XR NCS-55A2-MOD-SE-S Router now uses a satellite receiver, also called the Global Navigation Satellite System (GNSS), as the new timing interface.

This capability simplifies network synchronization planning, provides flexibility and resilience in resolving network synchronization issues in the hierarchical network.

Information About GNSS

Overview of GNSS

The following routers support the GNSS receiver:

- NCS-55A2-MOD-SL
- NCS-55A2-MOD-HD-S
- NCS-55A2-MOD-HX-S
- NCS-55A2-MOD-SE-S

There is no license required to enable the GNSS module.

The GNSS LED on the front panel indicates the status of the module. The following table explains the different LED status:

LED Status	Description
Green	GNSS NormalState.Selfsurvey is complete.
Amber	All other states

When connected to an external antenna, the module can acquire satellite signals and track up to 32 GNSS satellites, and compute location, speed, heading, and time. GNSS provides an accurate one pulse-per-second (PPS), a stable 10 MHz frequency output to synchronize broadband wireless, aggregation and pre-aggregation routers, and an accurate time-of-day (ToD).



Note NCS-55A2-MOD-SE-S can also receive 1PPS, 10 MHz, and ToD signals from an external clocking and timing source. However, the timing signals from the GNSS module (when enabled) take precedence over those of the external source.



Note It is not recommended to configure both front panel (10M, 1PPS and ToD) input along with GNSS input configuration.

By default, anti-jamming is enabled on the GNSS module.

Operation of GNSS Module

The GNSS module has the following stages of acquiring and providing timing signals to the Cisco router:

- **Self-Survey Mode** - When the router is reset, the GNSS module comes up in self-survey mode. It tries to lock on to minimum four different satellites and computes approximately 2000 different positions of the satellites to obtain a 3-D location (Latitude, Longitude, and Height) of its current position. This operation takes about 35 to 40 minutes. During this stage also, the module is able to generate accurate timing signals and achieve a Normal or Phase-locked state.

When GNSS moves into Normal state, you can start using the 1PPS, 10 MHz, and ToD inputs from GNSS. The quality of the signal in Self-Survey mode with Normal state is considered good enough to lock to GNSS.

- **Over determined clock mode** - The router switches to over determined (OD) mode when the self-survey mode is complete and the position information is stored in non-volatile memory on the router. In this mode, the module only processes the timing information based on satellite positions captured in self-survey mode.

The router saves the tracking data, which is retained even when the router is reloaded.

The GNSS module stays in the OD mode unless one of the following conditions occur:

- A position relocation of the antenna of more than 100 meters is detected. This detection causes an automatic restart of the self-survey mode.
- A manual restart of the self-survey mode or when the stored reference position is deleted.

- A worst-case recovery option after a jamming-detection condition that cannot be resolved with other methods.

You can configure the GNSS module to automatically track any satellite or configure it to explicitly use a specific constellation. However, the module uses configured satellites only in the OD mode.



Note GLONASS and BeiDou satellites cannot be enabled simultaneously.

When the router is reloaded, it always comes up in the OD mode unless:

- the router is reloaded when the Self-Survey mode is in progress.
- the physical location of the router is changed to more than 100 m from its pre-reloaded condition.

When the system restarts GNSS self-survey by using the default `gnss slot R0/R1` command in config mode, the 10MHz, 1PPS, and ToD signals are not changed and remain up.

Prerequisites for GNSS

To use GNSS, the antenna must see as much as possible from the sky. For proper timing, minimum of four satellites must be locked. For more information, see the *Cisco NCS 5500 Series Router Hardware Installation Guide*.

Restrictions for GNSS

- The GNSS module is not supported through SNMP; all configurations are performed through commands.
- GNSS holdover performance is 1 microsecond in two hours of holdover after 12 hours of GNSS lock time.
- TDEV fails marginally on NCS-55A2-MOD-SE-S with GNSS input.

Configure GNSS

Configuration Example

This section describes how you can configure GNSS for NCS 5500 Series Router.

```
/* Enable the GNSS receiver and enter the gnss-receiver submode */
```

```
RP/0/RP0/CPU0(config)# gnss-receiver 0 location 0/0/CPU0
RP/0/RP0/CPU0(config-gnss)# frequency synchronization
RP/0/RP0/CPU0(config-gnss-freqsync)# selection input
```

Optional Configuration Example

```
RP/0/RP0/CPU0(config)# gnss-receiver 0 location 0/0/CPU0
RP/0/RP0/CPU0(config-gnss)# anti-jam disable
RP/0/RP0/CPU0(config-gnss)# constellation GPS
```

```
RP/0/RP0/CPU0(config-gnss)# snr threshold 10
RP/0/RP0/CPU0(config-gnss)# frequency synchronization
RP/0/RP0/CPU0(config-gnss-freqsync)# selection input
RP/0/RP0/CPU0(config-gnss-freqsync)# priority 5
RP/0/RP0/CPU0(config-gnss-freqsync)# wait-to-restore 180
```

Running Configuration

```
gnss-receiver 0 location 0/RP0/CPU0
frequency synchronization
selection input
wait-to-restore 0
!
!
```

Verification

```
# show gnss-receiver
GNSS-receiver 0 location 0/RP0/CPU0
  Status: Available, Up
  Position: 741:12.12 N 4451:39.60 E 0.827km
  Time: 2019:01:17 14:43:08 (UTC offset: 18s)
  Firmware version: 1.4
  Lock Status: Phase Locked, Receiver Mode: 3D-fix
  Survey Progress: 100, Holdover Duration: 0
  Major Alarm: Not used
  Minor Alarm: Not used
  Anti-jam: Enabled, Cable-delay compensation: 0
  1PPS polarity: Positive
  PDOP: 6.000, HDOP: 0.000, VDOP: 0.000, TDOP: 1.000
  Constellation: GPS, Satellite Count: 10
```