

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.

This chapter describes the Global Navigation Satellite System (GNSS) and the procedures used to configure the GNSS port for fixed-port routers.

- Configuring the Global Navigation Satellite System, on page 2
- Information About GNSS, on page 2
- Configure GNSS, on page 5

Configuring the Global Navigation Satellite System

Table 1: Feature History Table

Feature Name	Release	Description
Extending GNSS Functionality to Cisco Network Convergence System 5700 Series variants	Release 7.5.1	A Global Navigation Satellite System (GNSS) receiver receives radio signals from GNSS satellites and decodes the information from multiple satellites to determine its distance from each satellite. Based on this data, the GNSS receiver identifies the location of each satellite. This feature is supported on the following variants of Cisco Network Convergence System 5700 Series fixed chassis: • NCS-57B1-6D24-SYS • NCS-57B1-5DSE-SYS For more information about the Cisco NCS 5700 series fixed chassis, see the Cisco NCS-57B1 Fixed Chassis Data Sheet.

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.

To optimize the GNSS system, it requires all the systems to share a common time scale and coordinated system. If all the systems do not have a common time, the receiver sees a time offset and then the receiver will have to select only one constellation having common time scale. Then there will be a requirement to add more satellites to increase the coverage of the constellation itself.

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

These Cisco IOS XR routers now support on board GNSS receiver to recover time.

Information About GNSS

Overview of GNSS

The following routers support the GNSS receiver:

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

Starting from Cisco IOS XR Release 7.5.1, the following 57B1 variants of NCS 5700 fixed chassis support GNSS receiver:

- NCS-57B1-6D24-SYS
- NCS-57B1-5DSE-SYS

No license is required to enable the GNSS module. The GNSS LED on the front panel indicates the status of the module. The following table describes the different status of GNSS LED:

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

The following table describes the different status of GNSS LED for 5700 Series variants:

LED Status	Description
Green	GNSS is Locked to an RF input (Satellites)
Amber	GNSS Receiver not Locked RF input(Satellites)
OFF	GNSS not configured

NCS-57B1-6D24-SYS and NCS-57B1-5DSE-SYS 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. For more information, see the Cisco NCS 5700 series: NCS-57B1 Fixed Chassis Data Sheet.

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 We do not recommend that you configure both the front panel (10M, 1PPS and ToD) input configuration and the 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 a minimum of four different satellites and computes approximately 2000 different positions of the satellites to obtain a 3-D location (Latitude, Longitude, and Height) of it 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.
- 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, a minimum of four satellites must be locked. For more information, see the *Cisco NCS 5500 Series Router Hardware Installation Guide or Cisco NCS 5700 Series Router Hardware Installation Guide*.

Restrictions for GNSS

- The GNSS module is not supported through SNMP; all configurations are performed through commands.

- The GNSS holdover performance is one microsecond in two hours of holdover after twelve hours of GNSS lock time.
- TDEV fails marginally on NCS-55A2-MOD-SE-S with GNSS input.

Configure GNSS

Configuration Example

You can configure any of the following constellation options for a router:

- GPS
- Galileo
- GLONASS
- BeiDou
- QZSS

Based on your configuration, the output displays the status of the GNSS receiver on the router models.

This section describes how you can configure GNSS for a router.

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

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

Optional Configuration Example

```
Router(config)# gnss-receiver 0 location 0/0/CPU0
Router(config-gnss)# anti-jam disable
Router(config-gnss)# constellation GPS
Router(config-gnss)# snr threshold 10
Router(config-gnss)# frequency synchronization
Router(config-gnss-freqsync)# selection input
Router(config-gnss-freqsync)# priority 5  >>>Values can range from 1 (highest priority) to
 254 (lowest priority). The default value is 100.
Router(config-gnss-freqsync)# wait-to-restore 0
```

Running Configuration

```
gnss-receiver 0 location 0/RP0/CPU0
frequency synchronization
  selection input
  priority 1
  wait-to-restore 0
  quality receive exact itu-t option 1 PRC
 !
!
```

Verification

The following is the output of the **show gnss-receiver** command on the router models.

```
# 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
```

```
Router# show gnss-receiver
Fri Jan 17 07:27:34.804 UTC
GNSS-receiver 0 location 0/RP0/CPU0
    Status: Available, Up
    Position: 12:56.18 N 77:41.77 E 0.823km
    Time: 2020:01:17 07:31:41 (UTC offset: 0s)
    Locked at: 2020:01:15 17:15:28
    Firmware version: TIM 1.10
    Lock Status: Phase Locked, Receiver Mode: Time fix only
    Survey Progress: 100, Holdover Duration: Unknown
    Major Alarms: Unknown
    Minor Alarms: Unknown
    Anti-jam: Enabled, Cable-delay compensation: 0
    1PPS polarity: Positive
    PDOP: 99.990, HDOP: 99.990, VDOP: 99.990, TDOP: 0.240
    Constellation: GPS, Satellite Count: 17
    Satellite Thresholds:
        SNR - 0 dB-Hz, Elevation - 0 degrees, PDOP - 0, TRAIM - 0 us
    Satellite Info:
        CHN: Channel, AQUN: Aquisition, EPH: Ephemeris
        PRN   CHN   AQUN   EPH    SV            Signal
        No.   No.   Flag   Flag   Type          Strength   Elevat'n   Azimuth
        ---   ---   ----   ----   -----------   --------   --------   --------
          1   n/a   On     On     GPS             44.000     19.000    220.000
          3   n/a   On     On     GPS             48.000     62.000    299.000
          4   n/a   On     On     GPS             46.000     30.000    338.000
          7   n/a   On     On     GPS             47.000      9.000    261.000
          8   n/a   On     On     GPS             41.000     17.000    172.000
          9   n/a   On     On     GPS             44.000      7.000    317.000
         11   n/a   On     On     GPS             42.000     10.000    202.000
         14   n/a   On     On     GPS             42.000     22.000     90.000
         16   n/a   On     On     GPS             46.000     66.000     59.000
         22   n/a   On     On     GPS             47.000     71.000    238.000
         23   n/a   On     On     GPS             46.000     27.000    332.000
         26   n/a   On     On     GPS             48.000     40.000     40.000
```