Configuring the Global Navigation Satellite System

The chassis uses a satellite receiver, also called the global navigation satellite system (GNSS), as a new timing interface.

In typical telecom networks, synchronization works in a hierarchal manner where the core network is connected to a stratum-1 clock and this 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 using an on-board GPS chips.

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

Information About the GNSS

Overview of the GNSS Module

The GNSS module is present on the front panel of the RSP3 module and can be ordered separately with PID=. However, there is no license required to enable the GNSS module.

The GNSS LED on the RSP3 front panel indicates the status of the module. The following table explains the different LED status.

LED Status	Description
Green	GNSS Normal State. Self survey 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 The RSP3 module 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.

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

Operation of the 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 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.

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. If you want to change the tracking data, use the **no shutdown** command to set the GNSS interface to its default value.

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. GALILEO is not supported.

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 it's pre-reloaded condition.

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

Anti-Jamming

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

High Availability for GNSS

The chassis has two GNSS modules, one each on the active and standby RSP3 modules. Each GNSS module must have a separate connection to the antenna in case of an RSP3 switchover.

Prerequisites for GNSS

To use GNSS:

- 1PPS, 10 MHz, and ToD must be configured for netsync and PTP. For more information see the Configuring Clocking and Timing chapter .
- The antenna must have a clear view of the sky. For proper timing, minimum of four satellites should be locked. For information, see the *Cisco NCS 4206 Series Hardware Installation Guide* .

Restrictions for GNSS

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

- On HA system, the traps from the standby system are logged to the console as the SNMP infra does not get enabled on standby RSP module.

- GNSS objects or performance counters are updated every 5 seconds locally and acknowledge the MIB object request accordingly.

- GNSS traps generation is delayed for 300 seconds for the first time after system startes to avoid any drop of GNSS traps.

How to Configure the GNSS

Note To know more about the commands referenced in this document, see the Cisco IOS Master Command List .

Enabling the GNSS License

```
enable
configure terminal
license feature gnss
exit
```

Enabling the GNSS on the Cisco Router

```
enable
configure terminal
gnss slot r0
no shutdown
exit
```

Note   After the GNSS module is enabled, GNSS will be the source for 1PPS, ToD, and 10MHz clocking functions.

Configuring the Satellite Constellation for GNSS

```
enable
configure terminal
gnss slot r0
constellation [auto | gps | galelio | beidou | qzss
exit
```

Configuring Pulse Polarity

```
enable
configure terminal
gnss slot r0
1pps polarity negative
exit
```

Note   The **no 1pps polarity negative** command returns the GNSS to default mode (positive is the default value).

Configuring Cable Delay

```
enable
configure terminal
gnss slot r0
1pps offset 5
exit
```

Note   It is recommended to compensate 5 nanosecond per meter of the cable.

The **no 1pps offset** command sets cable delay offset to zero.

Disabling Anti-Jam Configuration

```
enable
configure terminal
gnss slot

ro
anti-jam disable
exit
```

Verifying the Configuration of the GNSS

Use the **show gnss status** command to display status of GNSS.

```
Router# show gnss status
GNSS status:

  GNSS device: detected
  Lock status: Normal
  Receiver Status: Auto
  Clock Progress: Phase Locking
  Survey progress: 100
  Satellite count: 22
  Holdover Duration: 0
  PDOP: 1.04   TDOP: 1.00
  HDOP: 0.73   VDOP: 0.74
  Minor Alarm: NONE
  Major Alarm: None
```

Use the **show gnss satellite** command to display the status of all satellite vehicles that are tracked by the GNSS module.

```
Router# show gnss satellite all
All Satellites Info:

SV PRN No   Channel No      Acq Flg   Ephemeris Flg    SV Type    Sig Strength
-------------------------------------------------------------------------------
14          0                 1           1              0            47
21          2                 1           1              0            47
22          3                 1           1              0            46
18          4                 1           1              0            47
27          6                 1           1              0            44
31          8                 1           1              0            49
24          10                1           1              0            42
79          12                0           1              1            18
78          13                1           1              1            26

Router# show gnss satellite 21
Selected Satellite Info:

  SV PRN No: 21
  Channel No: 2
  Acquisition Flag: 1
 Ephemeris Flag: 1
  SV Type: 0
  Signal Strength: 47
```

```
Router# show gnss time

Current GNSS Time:

  Time: 2015/10/14  12:31:01 UTC Offset: 17

Router# show gnss location
Current GNSS Location:

  LOC: 12:56.184000 N  77:41.768000 E 814.20 m
```

Use the **show gnss device** to displays the hardware information of the active GNSS module.

```
Router# show gnss device
GNSS device:

  Serial number: FOC2130ND5X
  Firmware version: 1.4
  Firmware update progress: NA
  Authentication: Passed
```

Swapping the GNSS Module

Hot swap is supported on the RSP3 module of the GNSS.

1. Remove the standby RSP module.

2. Replace the GNSS module on the standby RSP slot.

3. Reinsert the RSP into the chassis and wait for the RSP to boot with standby ready.

4. Check for GNSS Lock Status of the standby RSP. Use command **show platform hardware slot** *<R0/R1>* [**network-clocks** | **sec GNSS**] to verify.

5. Trigger SSO after the GNSS on standby RSP is locked.

6. Repeat steps 1–3 for the other RSP.

Configuration Example For Configuring GNSS

```
gnss slot R0
no shutdown
anti-jam disable
constellation glonass
1pps polarity negative
1pps offset 1000 negative
```

Additional References

Standards

Standard	Title
—	There are no associated standards for this feature,

MIBs

MIB	MIBs Link
• There are no MIBs for this feature.	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
—	There are no associated RFCs for this feature.