



Configuring the Global Navigation Satellite System

Effective Cisco IOS-XE Release 3.17, the Cisco ASR-920-12SZ-IM router 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.

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Overview of the GNSS Module

The GNSS module is present on the front panel of the Cisco ASR-920-12SZ-IM router. The GNSS LED on the front panel indicates the status of the module. The following table explains the different LED status.

LED Status	Description
Off	GNSS is not configured.
Green	GNSS Normal State. Self-survey is complete.
Red	Power up. GNSS is not tracking any satellite.
Amber	Auto holdover.

LED Status	Description
Blinking green	Learning state—normal. Self-survey is not completed.

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 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 Cisco ASR-920-12SZ-IM router 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 ASR-920-12SZ-IM 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. 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 its 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.

Licensing of the GNSS Module

The GNSS is a fixed module on the Cisco ASR-920-12SZ-IM router and requires a license to enable the functionality.

After installing the license, you must enable it by using the **license feature gnss** command.



Note The GNSS module will shut down, if it is in use and the license is disabled.

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 in the *Cisco ASR 920 Series Aggregation Services Router Configuration Guide*.
- License must be enabled on the Cisco ASR-920-12SZ-IM router.
- The antenna should see as much as possible from the total sky. For proper timing, minimum of four satellites should be locked. For information, see the *Cisco ASR-920-12SZ-IM Aggregation Services Router Hardware Installation Guide*.

Restrictions for GNSS

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

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 (Required)
- Enabling the GNSS on the Cisco Router (Required)
- Configuring the Satellite Constellation for GNSS (Required)
- Configuring Pulse Polarity and Cable Delay (Required)
- Configuring Cable Delay (Required)
- Disabling Anti-Jam Configuration (Optional)

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
lpps polarity negative
exit
```



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

Configuring Cable Delay

```
enable
configure terminal
gnss slot r0
lpps offset 5 negative
exit
```



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

The **no lpps offset** command sets cable delay offset to zero.

Disabling Anti-Jam Configuration

```
enable
configure terminal
gnss slot r0
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
High Accuracy Mode: OFF

Authentication: Not checked
Firmware update progress: NA
Firmware version: 1.3
```

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
```

Use the `show gnss time` and `show gnss location` to display the time and location of the Cisco ASR-920-12SZ-IM router.

```
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: NA
Firmware version: 0.0
Firmware update progress: NA
Authentication: Not applicable
```

Configuration Example For Configuring GNSS

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

Additional References

Standards

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

MIBs

MIB	MIBs Link
<ul style="list-style-type: none"> • 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.

Feature Information for Configuring the GNSS

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.



Note The table below lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 1: Feature Information for Phrase Based on Module Title

Feature Name	Releases	Feature Information
Configuring GNSS	IOS-XE 3.17	This feature was introduced. The following commands were introduced: <ul style="list-style-type: none">• gns slot• anti-jam disable• constellation• 1pps polarity• 1pps offset