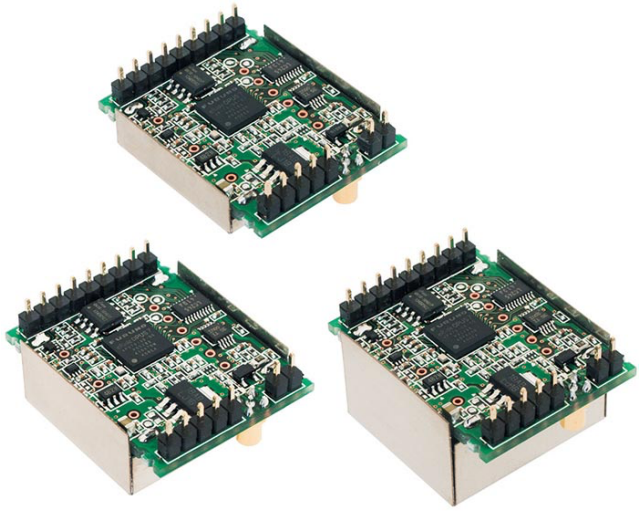
Multi-GNSS Disciplined Oscillator Model GF-8801/02/03

（GF-8801/GF-8802/GF-8803）



Ultra-small size form factor featuring atomic clock level frequency stability with 24h holdover.

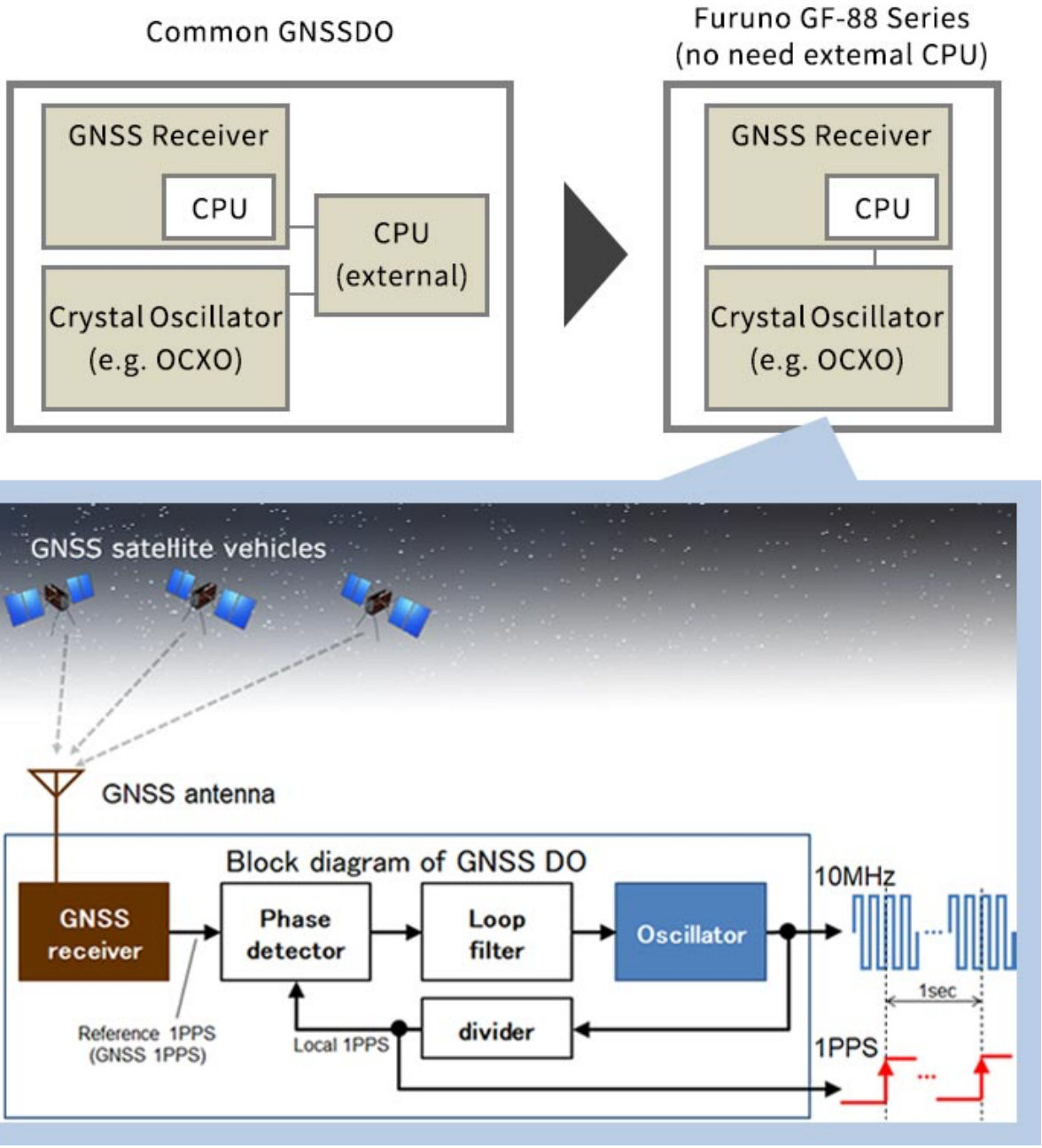
GF-88 series is a full-featured multi-GNSS disciplined oscillator (GNSSDO), embedded with multi-GNSS receiver, OCXO, LDO regulator and antenna detection circuit in a compact pin-header module.
It provides outputs of one-second pulse (1PPS), synchronized with Coordinated Universal Time (UTC), and reference frequency (10MHz) signal.

Combined with ultra-miniature OCXO, GF-8802 / 8803 (approx. 34mm x 27mm) builds up a holdover function which can maintain within 10μs / 24 hours(ex.GF-8803) in case that GNSS falls into unlock. There is also low-profile module called GF-8801

embedded with TCXO on the same form factor. 3 available models save significant time and effort during product design.

- **Generates UTC-synchronized 1PPS (pulse per second) and continuously disciplined 10 MHz**
- **One-module combining a GNSS receiver, crystal oscillator and peripheral circuits that dramatically reduces design cycle (time-to-market) of wireless system.**

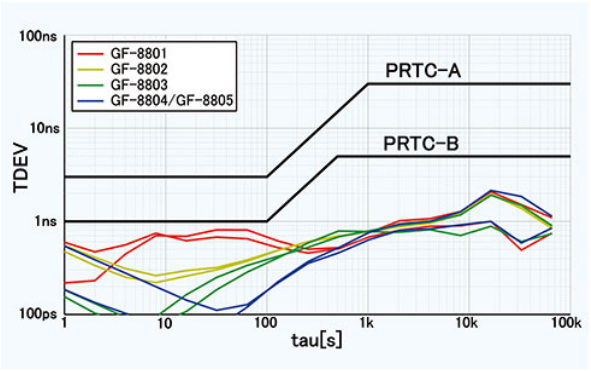
  GNSS Receiver manufacturer featured one-package solution (no need external CPU)

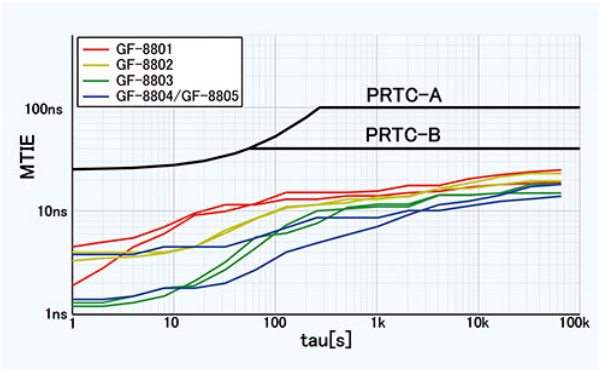


- ## Extremely high stability of 4.5ns (1sigma) using a single band receiver compliant with G.8272 PRTC-A, PRTC-B

FURUNO technology made it possible to achieve 5G performance with 4.5ns (1 sigma) stability by single band receiver. For example, GF-8803 is compliant with G.8272 PRTC-B. This is achieved by an improved and advanced position estimation algorithm. It optimizes position calculations using several different GNSS satellite constellations. It allows users to achieve 5G-required performance without changing existing single band GNSS antennas.

White Paper: High Stability of 4.5ns (1 sigma) using a single band GNSS timing receiver





- ## Suitable for various RF・Broadcasting applications. Designed functions aiming to solve usual troubles on site.

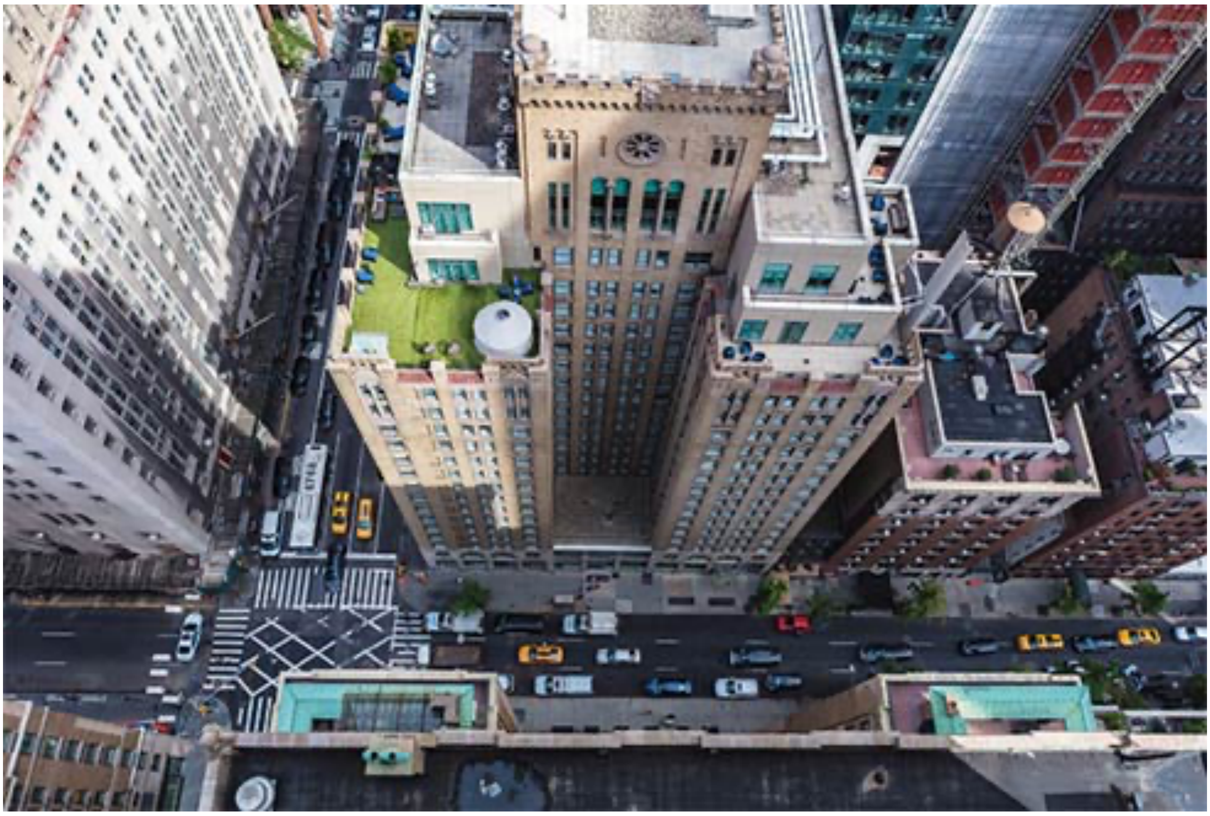
The number of radio stations applied with GNSS time synchronization, ex. PMR, local 5G, and V2X, has been increasing year by year. Especially in urban area, users have to face problems such as urban canyon (signals blocked) and multi-path (signals reflected) etc.

GF-88 series have embedded solutions against;

1. Multipath in Urban area
2. Jamming (interference wave)
3. Spoofing
4. Interruption of GNSS signal (holdover)

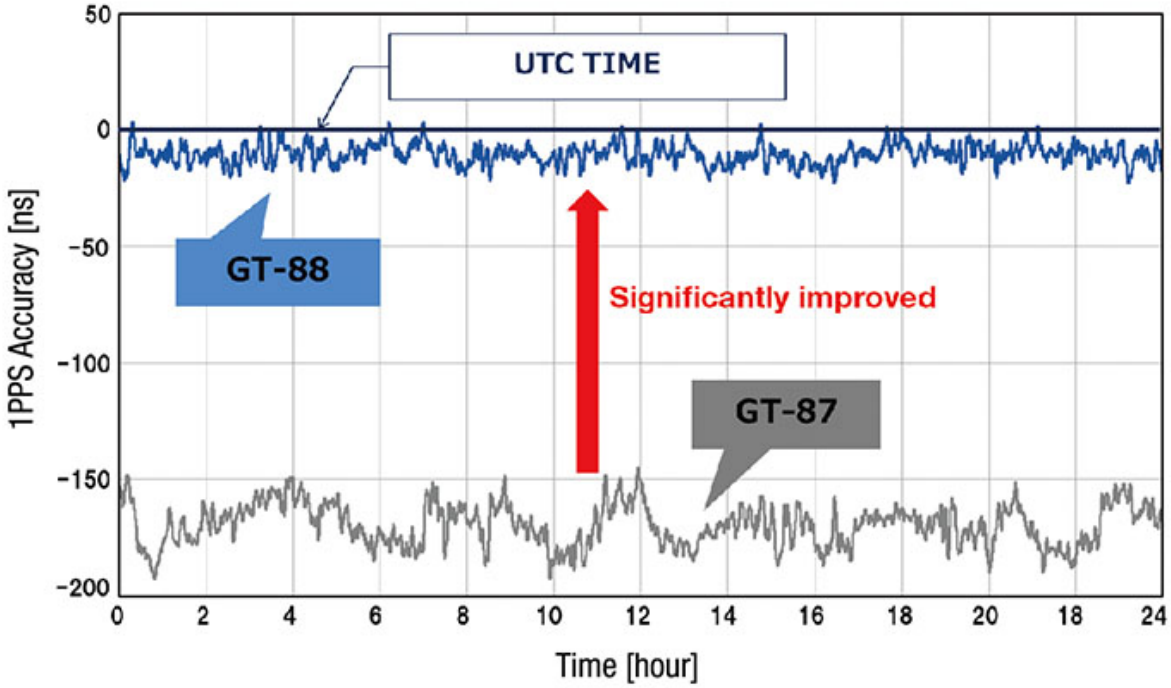
In addtion, as a longterm supplier of major mobile base venders, Furuno keeps the same carrier grade quality on GF series as well.

White Paper: Countermeasure for GNSS receiver failure



1.GNSS antennas can be mounted on walls and windows of tall buildings

The Dynamic Satellite Selection™* minimizes deterioration of time synchronization performance by choosing only the high quality satellite signals
* a new satellite signal selection algorithm developed by NTT



* GF-880x : GT-88 + OCXO/TCXO

2.Jamming (interference wave)

If GNSS receiver is interfered by jamming signals, it can mitigate the negative impact and prevent GNSS signal loss or failure. It also helps investigate the source by detecting and monitoring frequency and power level from the jamming signals.

3.Spoofing

Malicious spoofing signals intentionally mislead the position and timing calculation of the GNSS receiver. Therefore it is designed to detect and cancel such effects and protect the system from spoofing attack.

4.Interruption of GNSS signal (holdover)

Even if the receiving satellites are all lost due to antenna failure, jamming, signal interruption, the timing function keeps working for a holdover period of time.

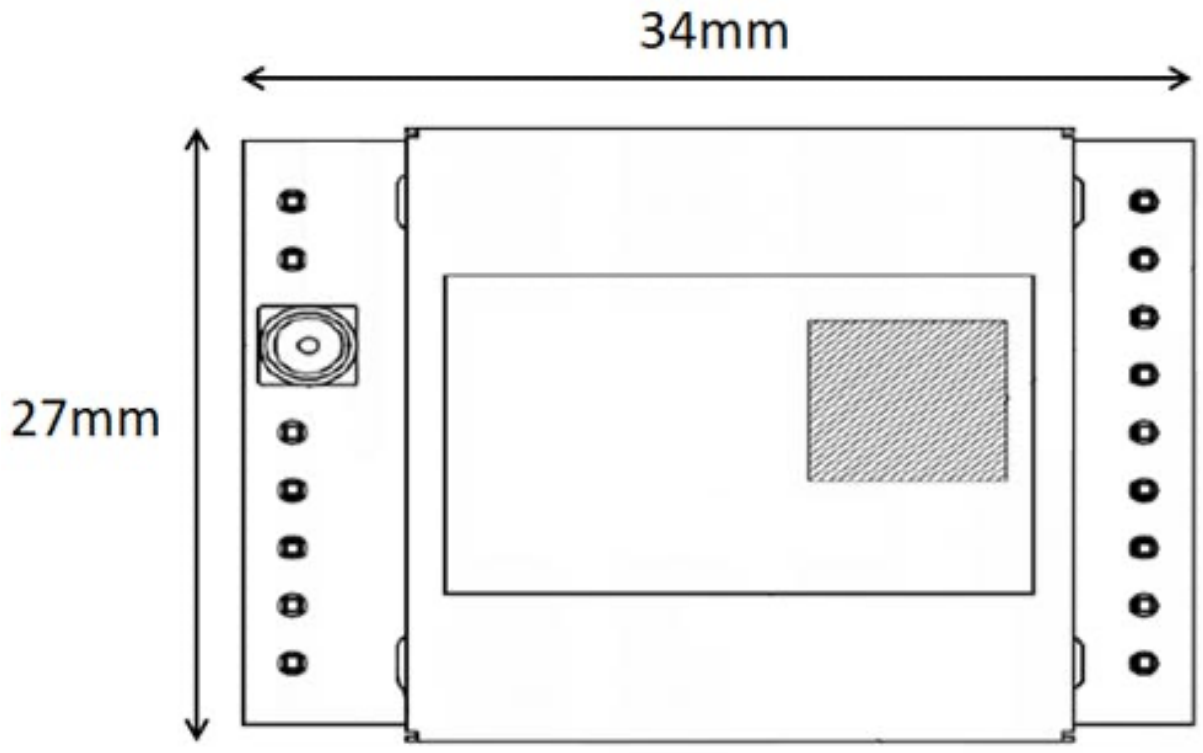
・In case GNSS positioning is interrupted, it predicts and corrects oscillator performance through exclusive adjusting technology.

・Excellent cost performance as replacement for atomic oscillator.

- **A lineup of 3 compact size models of "Short" form factor.**

GF-8801, GF-8802, GF-8803 are small and low-profile models for size oriented users. 3 models are all pin compatible with same output, the only difference is the holdover performance.

For very high accuarcy end users, GF-8804 and GF-8805 provides superlative holdover function (i.e. Grande form factor).



[Specification]

Form factor	Model	1PPS Accuracy		10MHz Short Term Stability (Root Allan variance (=1s))	Size (mm)
		Lock State	Holdover	Lock State, Holdover	
Short	GF-8801	< ±40ns	-	< 5×10^{-10}	34×27×11
	GF-8802	< ±40ns	< ±50μs/24h	< 5×10^{-11}	34×27×15.5
	GF-8803	< ±40ns	< ±10μs/24h	< 2×10^{-11}	34×27×20
Grande	GF-8804	< ±40ns	< ±5μs/24h	< 1×10^{-11}	100×52×20

	GF-8805	< ±40ns	< ±1.5µs/24h	< 1×10^{-11}	100×52×20

[Test data]
1PPS Timing Accuracy <± X µs continued from start of holdover.
* Reference information only, values not guaranteed.

Form factor	MODEL	1PPS Accuracy					
		< ±0.1µs	< ±0.4µs	< ±1.1µs	< ±1.5µs	< ±5µs	< ±10µs
Short	GF-8802	-	-	1h	2h	8h	16h
	GF-8803	-	1h	3h	4h	16h	-
Grande	GF-8804	-	2h	6h	8h	-	-
	GF-8805	2h	6h	18h	-	-	-

- **Coherent behavior between time pulse (jitter less 1PPS) and frequency (10 MHz)**
- **Single satellite tracking capable operations (except Navigation Mode)**
- **Synchronization with external pulse**
  Enables synchronizing to time pulse from an external source
  ・Usable to synchronize to time information such as IEEE1588 or SyncE obtained through the network
  ・Improves robustness of the system
- **Enhance performance in combination with recommended antenna**
  Multi-GNSS antenna AU-217 has highly noise resistant as well as highly environmental resistant equivalent to IP67. AU-217 is suitable for use with Furuno timing Multi-GNSS modules and disciplined oscillators.
  Here's more on Multi-GNSS antenna AU-217

Specifications

GENERAL

GNSS Reception Capability

GPS L1C/A, GLONASS L1OF, Galileo E1B/E1C, QZSS L1C/A, QZSS L1S, SBAS L1C/A

GNSS Reception

32 channels

Sensitivity

GPS
Tracking: > -162 dBm
Acquisition: > -148 dBm

GLONASS
Tracking: > -158 dBm
Acquisition: > -144 dBm

Galileo
Tracking: > -146 dBm
Acquisition: > -136 dBm

QZSS
Tracking： > -147 dBm
Acquisition： > -131 dBm

*Measurement platform with recommended active antenna

ITU-T Recommendation

GF-8801
Compliant with G.8272 PRTC-A

GF-8802/GF-8803
Compliant with G.8272 PRTC-A, PRTC-B

Initial Stabilization Time

< 5 minutes (until lock state)

10 MHz Output

Square pulse

10MHz Output (Lock State)

GF-8801
10MHz Long Term Stability (24h average): < ± 1 × 10^{-11}
10MHz Short Term Stability (Root Allan variance (=1s)): < 5 × 10^{-10}

GF-8802
10MHz Long Term Stability (24h average): < ± 1 × 10^{-12}
10MHz Short Term Stability (Root Allan variance (=1s)): < 5 × 10^{-11}

GF-8803
10MHz Long Term Stability (24h average): < ± 1 × 10^{-12}
10MHz Short Term Stability (Root Allan variance (=1s)): < 2 × 10^{-11}

1PPS Output (Lock State)

1PPS Accuracy: < ± 40ns (vs UTC)
1PPS Stability: < 4.5ns（1 σ）

*Open sky

10MHz Output (Holdover)

GF-8801
-

GF-8802
10MHz Long Term Stability (24h average): < ± 1 × 10^{-9}
10MHz Short Term Stability (Root Allan variance (=1s)): < 5 × 10^{-11}

GF-8803
10MHz Long Term Stability (24h average): < ± 2 × 10^{-10}
10MHz Short Term Stability (Root Allan variance (=1s)): < 2 × 10^{-11}

1PPS Output (Holdover)

GF-8801
-

GF-8802
1PPS Accuracy: < ± 50μs/24h
（< ± 3μs/1h(TYP))

GF-8803
1PPS Accuracy: < ± 10μs/24H
（< ± 3μs/1H(TYP))

Supply Voltage

3.7 VDC

Power Consumption

GF-8801
< 150 mA

GF-8802
450 mA（Typ）

GF-8803
600 mA（Typ）

*When supply voltage is stabilized

Operating Temperature

-40°C to +85°C

Antenna Detection

Short and Open Detection

Outer Size

GF-8801
34 mm x 27 mm x 11 mm

GF-8802
34 mm x 27 mm x 15.5 mm

GF-8803
34mm × 27mm × 20mm

Protocol

eSIP (NMEA 0183 Standard Ver 4.10)

Functions

Anti-Jamming (8CW), Multipath Mitigation (Dynamic Satellite Selection™), Anti-Spoofing, T-RAIM, Synchronization with external pulse