

OSA 5400 TimeCard™

Half-size PCIe card, PTP grandmaster, NTP server, boundary/slave clock



5G Mobile



Telecom



Defense



Data center



Smart grid



Transportation



Financial



Broadcast

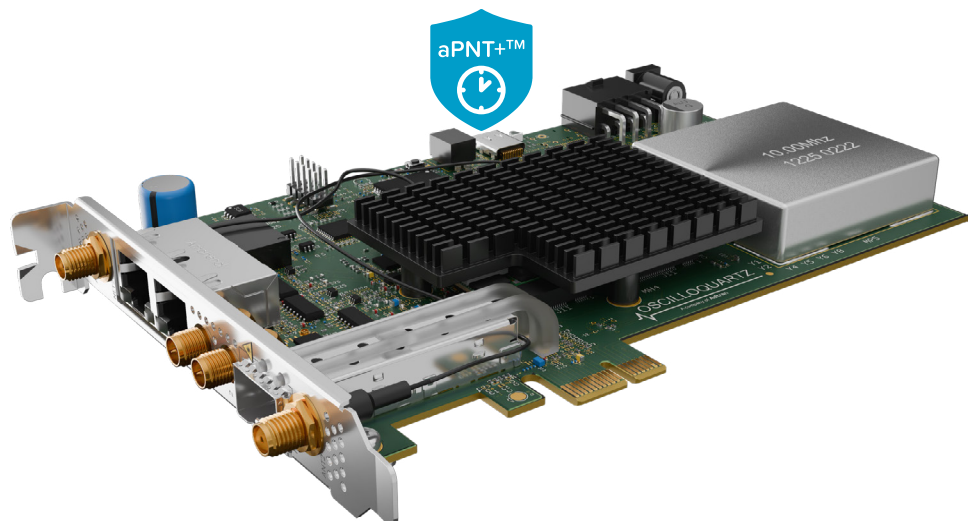
Benefits

- **Standard PCIe card**
Half-length, standard-height single and dual slot server card
- **PTM support**
ns -precision synchronization over PCIe bus using Precision Time Measurement
- **Sophisticated, feature -rich synchronization**
Built-in cost-efficient multi-band GNSS receiver enabling PRTC-B and IEEE 1588v2 grandmaster (GM), boundary (BC), slave clock (SC) and NTP server functionality
- **Resilient PNT**
Support of LEO-based STL receiver as an optional add on for synchronization when GNSS is not available
- **Multiple market segments**
Various time code support for different market requirements, such as NMEA, IRIG and HaveQuick/STANAG
- **Syncjack™ technology**
GNSS and synchronization assurance with comprehensive monitoring and analytics
- **Proven Oscilloquartz technology**
OSAinside™ for faster time to market with less development and integration effort, while providing comprehensive timing functions
- **Highest reliability**
Multiple fallback options, including high-stability OCXO/rubidium, SyncE and PTP can be used in the event of GNSS outage
- **Open control interfaces**
Management integration with standardized information models and optional use of our Mosaic Sync Director
- **High-accuracy White Rabbit HW ready**
sub nanosecond synchronization with a firmware upgrade only

Overview

Standard servers are taking over functions in different network segments, which previously used purpose-built hardware. Some support critical infrastructure applications that require tight synchronization for efficient and reliable operation. Typical server hardware alone cannot meet the required level of synchronization accuracy and resilience. Our OSA 5400 TimeCard™ is a pluggable timing solution for delivering and assuring precise synchronization. It leverages Oscilloquartz market-leading expertise and experience and can be plugged into standard servers for accurate PTP, SyncE, PPS and ToD synchronization.

The OSA 5400 TimeCard™ provides a comprehensive set of synchronization functions including a GNSS receiver, an optional STL receiver, PTP grandmaster, NTP server, SyncE and a very precise boundary clock. The half-size PCIe card can be plugged into any standard server to provide accurate timing, including a comprehensive set of management and assurance features. With the OSA 5400 TimeCard™ installed in a server, applications have access to accurate, resilient and robust synchronization. Precise time information is provided by a PTP and NTP time server, which can be synchronized to UTC with the onboard GNSS receivers. Other synchronization signals such as CLK, 1PPS and various ToD formats are also available. Our OSA 5400 TimeCard™ is essential for any server hosting mission-critical and time-sensitive applications.



Oscilloquartz multisource aPNT+™ platform

OSA 5400 TimeCard™

High-level specifications

Key capabilities

- Integrated MB-GNSS receiver
- Optional integrated STL receiver
- Integrated GM, BC, SC
- Integrated NTP server
- Robust design
- Add-on plugs into hosting device
- Extended holdover
- 1G/10G Ethernet support
- Up to 10 independent priority-based time references (GNSS, PTP, PPS/TOD)

PCIe card form factor

- PCIe interface
- Half-width, standard-height, single-or dual-slot size variants

PTP functionalities

- Configurable as GM, BC, slave clock and APTS
- GM supported profiles:
 - IEEE 1588 2008 L3/L2,
 - ITU-T 8265.1 / 8275.1 / 8275.2
 - Power, broadcast, 802.1AS
- PTP over L2 and over IPv4/IPv6 supported simultaneously

Timing accuracy

- ± 40 nsec from UTC
- G.8272 / G.8273.1 compliant PRTC-B
- G.811 compliant PRC
- G.8262 / G.8264 Sync-E

Management

- Remote and local management using SSH/Telnet/SNMP
- Managed via external Ethernet connection or directly via host internal networking
- Open control interfaces

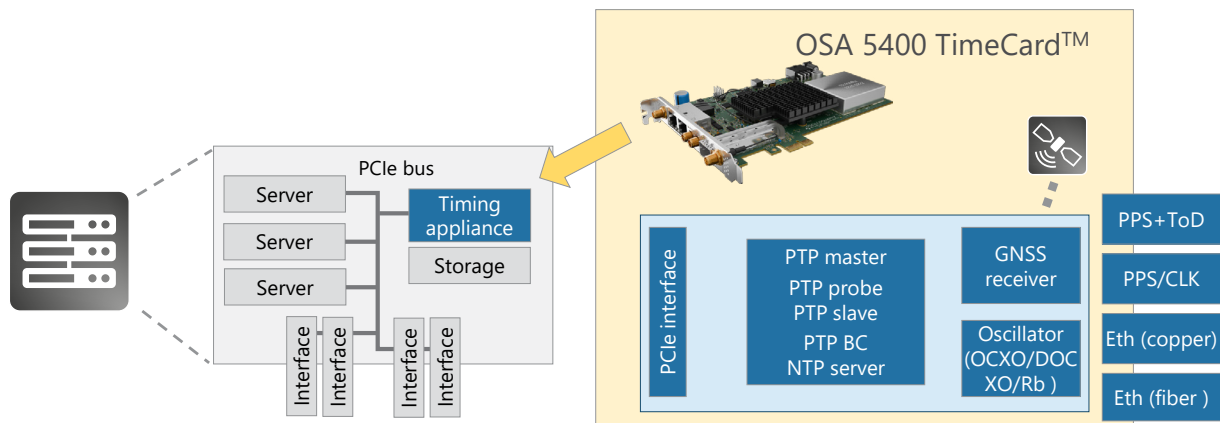
Built-in GNSS receiver

- Multi-band L1/L5 receiver
- Enhanced timing features
- Advanced jamming and spoofing detection
- Simultaneous usage of dual GNSS frequency bands
- GPS, GLONASS, BeiDou, Galileo, NavIC

Applications in your network

PCIe timing card

- PCIe pluggable card provides any server with accurate and robust timing
- Precise synchronization of mission-critical and time sensitive software application in mobile networks, critical infrastructure, power utilities and professional broadcasting, among others
- Time, frequency and phase synchronization with PTP, NTP, SyncE, TOD
- No need for external synchronization devices
- Enhanced control with direct management integration through open module control



OSA 5400 TimeCard™

Holdover performance

	Clock	Aging / day (after 30 days)	Temperature stability
Quartz	OCXO Stratum 3 / G.812 Type III	$\pm 5 \times 10^{-10}$	$\pm 50 \times 10^{-10}$
Quartz HQ+	High-quality OCXO G.812 Type I	$\pm 2 \times 10^{-10}$	$\pm 2 \times 10^{-10}$
Quartz HQ++	High-quality DOCXO Stratum 2 / G.812 Type II	$\pm 5 \times 10^{-11}$	$\pm 1 \times 10^{-11}$
Rubidium	Rubidium Stratum 2 / G.812 Type II	$\pm 5 \times 10^{-12}$	$\pm 2 \times 10^{-10}$

Note: Effective daily aging after device has been powered for one month

	200nsec	400nsec	1.1usec	1.5usec	5usec	10usec	16ppb	After 24 hours
Quartz	1 hours	2 hours	4 hours	8 hours	8 hours	14 hours	1 month	22 us
Quartz HQ+	4 hours	8 hours	14.5 hours	16.5 hours	1.5 days	2 days	0.5 days	2.3 us
Quartz HQ++	10 hours	17 hours	1.5 hours	4.4 days	4.4 days	6.6 days	>1.5 years	600ns
Rubidium	1 day	1.8 hours	3.5 days	4 days	8 days	12 days	>5 years	200ns

Note: The above are typical values (1 sigma confident) assuming controlled temperature environment, after the device has been powered for one month and locked to GPS for 72 hours. Due to the excellent temperature stability of the HQ++, the HQ++ holdover will outperform the rubidium holdover when significant temperature variations are presented.

Main applications

- 1588v2 PTP grandmaster, boundary, and slave clocks
- PTP to Sync-E and Sync-E to PTP conversion
- GNSS receiver operating as PRTC and PRC
- NTP server
- Timecode conversion (NMEA, IRIG, HQ/STANAG)

PTP master modes of operation

- PTP Telecom profiles:
 - ITU-T G.8265.1 & Telecom2008 frequency delivery profiles
 - ITU-T G.8275.2 time/phase delivery profile
 - ITU-T G.8275.1 time/phase delivery profile (full timing support) also used for DOCSIS 3.1
- PTP enterprise profile (mixed IP multicast and unicast)
- PTP power and utility profiles:
 - IEC/IEEE 61850-9-3
 - IEEE C37.238-2011
 - IEEE C37.238-2017
- PTP broadcast profiles:
 - SMPTE ST 2059-2
 - AES67 media profile
- Grandmaster simultaneous support for multiple profiles

PTP slave modes of operation

- PTP power and utilities profiles
 - IEC/IEEE 61850-9-3
 - IEEE C37.238-2011
 - IEEE C37.238-2017
- PTP telecom profiles:
 - ITU-T G.8265.1 & Telecom2008 frequency delivery profiles
 - ITU-T G.8275.2 time/phase delivery profile (APTS, partial timing support with BMCA and automatic asymmetry compensation to two remote masters)
 - ITU-T G.8275.1 time/phase delivery profile (full timing support)
- IEEE1588v2 default PTP profiles over L3 (Annex D) and L2 (Annex F)
- PTP enterprise profile (Mixed IP multicast and unicast)

PTP features

- Up to 64 unicast slaves at 128pps
- Full featured IEEE 1588-2008 PTP grandmaster, boundary, and slave clocks
- Assisted partial timing support (APTS) – PTP input to backup GNSS outage over network with partial/no timing support

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- 1-step and 2-step clock
- Dedicated or common IP PTP interface
- VLAN (IEEE 802.1Q) or untagged
- Sync-E input to PTP output (frequency) conversion
- Conversion between PTP profiles
- Maintain PTP slaves list
- Fixed asymmetry compensation

Synchronous Ethernet (SyncE)

- Compliant to the relevant sections of ITU-T G.8261 / G.8262 / G.8264
- Supported on ingress and egress
- G.811 compliant Sync-E primary reference clock (PRC) when locked to GNSS
- Ethernet synchronization message channel (ESMC)
- SyncE input for time holdover during GNSS outage

NTP server

- Smallest NTP server formfactor
- Security-hardened NTP server with Hardware-based responder
- Stratum 1 NTP server when locked to GNSS
- NTP v1, v2, v3, v4 and SNTP over IPv4 /IPv6
- TIME & DAYTIME protocols
- Hardware-based timestamping
- Within $\pm 100\text{nsec}$ from UTC
- Hardware base DoS protection using NTP responder
- Up to 500,000 transactions per second
- Support PTP and NTP on same port
- PTP to NTP translation
- PTP backup in case of GNSS outage
- Stationary or moving platforms

GNSS receiver

- Provides high accuracy for PRTC-B applications
- Accuracy within $\pm 40\text{nsec}$ from UTC
- Multi-band (L1+L5), multi-constellation GNSS receiver
- Supports single satellite timing modes
 - Survey fixed location
 - Configurable fixed location
- Navigation mode
- Configurable satellites SNR and elevation masks
- Advanced spoofing and jamming detection on device level
- AI based spoofing and jamming detection based on Mosaic Controller featuring NMS GNSS assurance
- GPS/QZSS L1 C/A and GLONASS L1OF, BeiDou B1, Galileo E1, SBAS (QZSS, WAAS, EGNOS, MSAS), NavIC
 - Up to four concurrent GNSS constellations
 - User-configurable antenna cable delay compensation
 - Micro-Miniature AMC4 RF connector, 50ohm (1.2mm mated height max)
 - 3.3V@100mA max

STL Receiver

- Provides authenticated timing / location from LEO satellites
- Accuracy within $\pm 100\text{nsec}$ from UTC (1-sigma) with outdoor antenna
- Position accuracy within 30 meters (1-sigma), after 1 hour survey, with outdoor antenna
- Operates with either outdoor or indoor antenna installations
- Unaffected by high multipath, urban canyon environments
- LEO high-power signal reception (resilient to spoofing)
- Authenticated signal (resilient to manipulation)
- Voltage to antenna: 3.3V or 5V user configurable
- Antenna connector SMA-F (50 ohms)

External antenna

- User-configurable antenna cable delay compensation
- Voltage to antenna: +3.3VDC
- Antenna connector SMA-F (50ohm)
- STL antenna connector (with STL option)



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Ethernet interfaces

- Hardware-based timestamping
 - 100/1000BaseT – copper
 - 1G/10G SFP/SFP+ – fiber
- Ethernet over PCIe interface (for Management)

I/O timing signals:

- HaveQuick/STANAG (STANAG 4246 HQ I/HQ II, 4430 XHQ/XHQ EDI, 4372 HQ IIA (Saturn) and ICD-GPS-060
- PPS (5V/10V)
- CLK
- ToD (NMEA 0183 – ZDA)
- IRIG-B (B002/004/006/007) DCLS. AM options available per demand with FW upgrade

Programmable I/O:

- CH1: SMA-F PPS/ CLK / IRIG / STANAG / HQ (10MHz) I/O, 50 ohm
- CH2: SMA-F PPS/ CLK / IRIG / STANAG / HQ (10MHz) I/O, 50 ohm
- RS485 over RJ-45 port: 4x PPS /NMEA /IRIG /STANAG / HaveQuick

Frequency accuracy

- G.811 compliant PRC while locked to GNSS

Indicators

- On board LEDs for power/GNSS/STL/Ethernet status indication

Time and phase accuracy

- G.8272 / G.8273.1 compliant PRTC (± 100 nsec from UTC, MTIE <100 nsec) while locked to GNSS
- During GNSS outage: time holdover using a G.811 PRC / G.8272 PRTC Sync-E input
 - Traceable to G.811 PRC: Time Error $< \text{UTC} \pm 1\mu\text{sec}$ for 24 hrs
 - Traceable to G.8272 PRTC: Time Error $< \text{UTC} \pm 1\mu\text{sec}$ for 72 hrs

Indicators

- On board LEDs for power/GNSS/Ethernet status indication

Syncjack™ monitoring and assurance tools

- Clock accuracy for up to two clock probes – computing TE and TIE of physical clocks
- Calculation TE/TIE between physical source and reference signals
- Programmable source and reference signals including SyncE, GNSS, PTP recovered clock.
- TE/TIE raw data collection and export to server
- Clock Analysis for up to two PTP clock probes – packet TE/TIE

- Calculation of packet TE/TIE between physical reference signal and timestamps within the PTP packets
- Programmable reference signals including SyncE and GNSS
- TE/TIE raw data collection and export to server

Management and security

- In-band management option via Host CPU (Ethernet over PCIe)
- In band management option via Copper or Fiber Ethernet ports
- Remote CLI – Telnet & SSH (Secure Shell)
- Separate MGMT IP & PTP address
- VLAN and untagged
- System software download via TFTP & SCP (secure copy)
- Enable or disable each of the protocol via CLI
- Alarm log
- Syslog
- Remote authentication via RADIUS
- Remote, secured backup and restore
- Remote, secured SW upgrade
- Low touch provisioning using configuration file
- Multi-level user access
- Access control list (ACL)
- Full management using SNMP v2 / v3 including authentication and encryption
- Alarms, inventory, and traps reporting to NMS
- Managed by Mosaic Controller and Mosaic Sync Director, including GNSS assurance toolkit

Regulatory and standards compliance

- ITU-T G.8261, G.8262, G.8264
- ITU-T G.8272, G.811
- ITU-T G.8265.1, G.8275.1, G.8275.2
- IEEE 1588v2 (PTP)
- RFC 1059 (NTPv1), RFC 1119 (NTPv2), RFC 1305 (NTPv3), RFC 5905 (NTPv4), RFC 4330 (SNTPv4)
- RFC868 (TIME), RFC867(DAYTIME)
- ETSI EN 300 386 V1.6.1
- EN 55024
- EN 55022 Class-B
- AS/NZS CISPR 22
- FCC CFR 47 Part 15 Subpart B
- ANSI C63.4 Class-B
- IEC/EN 61000-3-2
- IEC/EN 61000-3-3
- IEC/EN 61000-4-2 (ESD): ± 15 kV / ± 8 kV (air/contact)
- IEC/EN 61000-4-3 (RI)
- IEC/EN 61000-4-4 (EFT): 1 kV / 50 A (5/50 ns)

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- IEC/EN 61000-4-5 (Surge): 4KV (10/700 μ s)
- IEC/EN 61000-4-6 (CI)
- EN 60950-1: +A11, +A12, +2 (SAFETY)
- RoHS compliance

Mechanical

- Height – 111.15mm , Half-length – 165mm
- Width – HQ+ : 14.47mm (single slot)*,
HQ++/Rubidium : 34.8 mm (dual slot)

Note:* HQ++ and Rubidium height exceeds single slot height. 2 slot vacancy is required (34.8 mm width). it is possible to insert a short PCIe slot adjacent to the 5400TC with HQ++/Rb, if its length is < 130mm)

Environmental

- Operating temperature: -40°C to 85°C
- Storage temperature: -40°C to +85°C / -104 to 185°F
- Humidity: 5 to 95% (non-condensing)

Power consumption

- Without STL receiver:
 - Quartz: 6.5W (typical), 10.5W (max.)
 - Quartz HQ+: 8.5W (typical), 14.5W (max.)
 - Quartz HQ++: 10.5W (typical), 18.5W (max.)
 - Rubidium: 12.5W (typical), 20.5W (max.)
- Additional power with with STL receiver-up to 4W

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