Oscilloquartz edgeSync+™

OSA 5420 Series

## Compact PTP grandmaster, multi-interfaces

Benefits

- **Leading edge GNSS receiver**
  Enables PRTC/PRC and grandmaster clock functionality for frequency, phase and time-of-day delivery using multiple constellations

- **Unique flexibility**
  Configurable to operate in PTP grandmaster clock, assisted partial timing support (APTS), boundary clock and slave clock mode as well as NTP server and SSU/TSG

- **Extended holdover performance**
  High-end quartz and rubidium oscillator options

- **High-availability design**
  Automatic clock selection, self-calibrating delay asymmetry compensation, power supply redundancy and DoS protection

- **Syncjack™ technology**
  Built-in synchronization accuracy monitoring, testing and assurance functionality

- **Operational simplicity**
  Ensemble Controller, including Ensemble Sync Director, for superior management and synchronization monitoring capabilities

Overview

As radio access networks evolve to support ever higher data rates, assured phase, frequency and time-of-day synchronization at the edge of mobile backhaul networks becomes essential. But achieving this in a cost-effective way is a major challenge.

Are you struggling with high packet delay variation and delay asymmetries across your mobile backhaul network? Do you have difficulties in meeting frequency and phase synchronization accuracies required by 5G and LTE Advanced technology? Our OSA 5420 Series can help. This family of IEEE 1588v2 Precision Time Protocol (PTP) grandmaster devices has been optimized for deployment at the network edge. It ensures that cost-effective and accurate synchronization is no longer a challenge. What's more, with its NTP server and GNSS receiver capabilities including multiple synchronization fan-out options, our OSA 5420 Series is also ideal for deployment in legacy synchronization architectures.
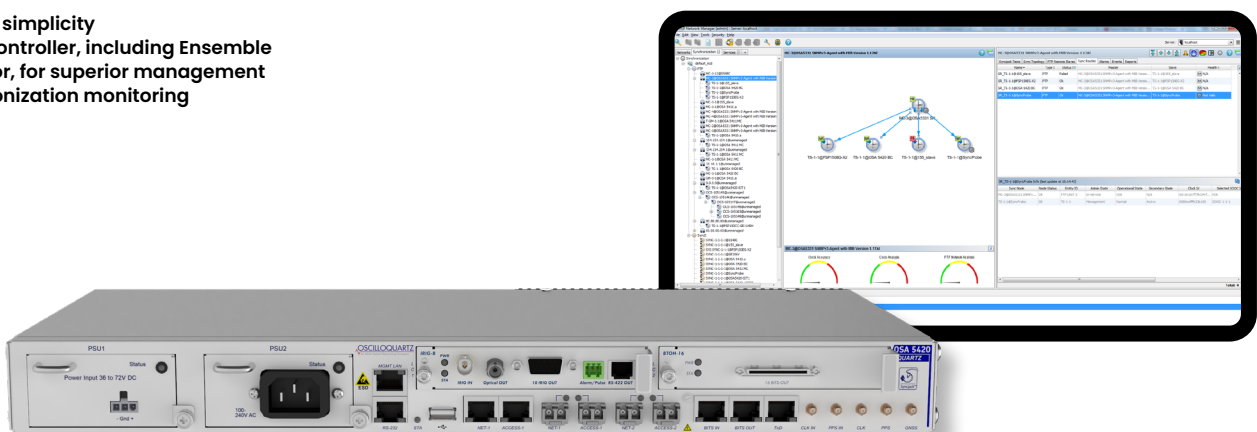
OSA 5420 SERIES

High-level technical specifications

OSA 5420 Series
- High-quality OCXO, DOCXO and rubidium
- Up to two expansion line cards
- Up to 1024 unicast slaves @128pps
- Hot-swappable redundant PSU

Operation modes
- PTP GM, BC, slave, probe
- NTP server
- SSU – up to 32 x E1 / T1 outputs
- GNSS receiver fan-out – up to 32x clock / PPS / PPS+ToD

Built-in GNSS receiver
- GPS/GLONASS/BEIDOU/ GALILEO
- GPS+GLONASS
- GPS+BEIDOU
- GPS+GALILEO

IEEE 1588 2008 PTP profiles
- Default profiles over Ethernet and IP multicast
- Telecom profiles
- Enterprise hybrid profile
- Power and utility profiles
- Broadcast profiles

NTP server
- High capacity server
- Hardware timestamping
- NTP/PTP/Sync-E/SSU supported simultaneously
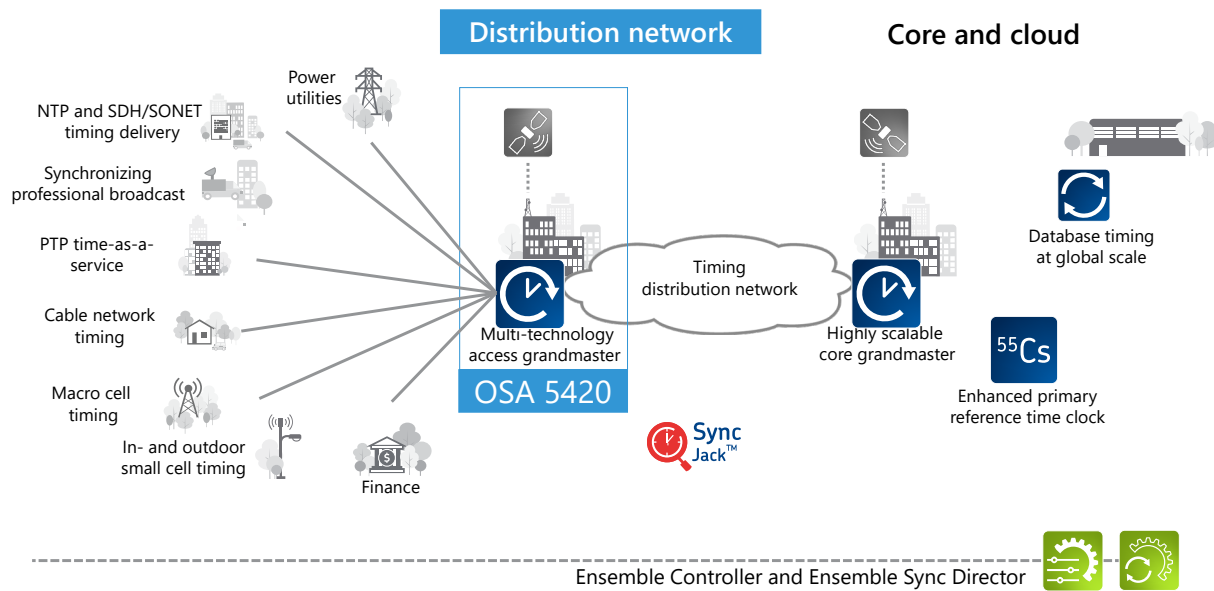- PTP to NTP conversion

Expansion cards
- 16x E1/T1/ 2.048MHz outputs (120/100/ 75ohm)
- 16x PPS outputs (50ohm) 16x clock (10/5MHz 50ohm)
- 16x PPS+ToD outputs (RJ-45)
- 4x 1GbE (Fiber)
- Time code IRIG I/O

Applications in your network

Radio access network synchronization and time-as-a-service applications with the highest availability

- Timing distribution at the edge of mobile backhaul and fronthaul networks
- Cable networks (DOCSIS 3.1) synchronization
- Synchronization delivery within buildings for indoor small cell radio base stations
- Synchronization of legacy network architectures based on NTP and SSU
- Time as a service into data center, financial, health and media networks
- Modernized and legacy power utility networks
- Modernized digital bradcasting studios

Distribution network

Core and cloud

Power utilities

NTP and SDH/SONET timing delivery

Synchronizing professional broadcast

PTP time-as-a-service

Cable network timing

Macro cell timing

In- and outdoor small cell timing

Finance

Multi-technology access grandmaster

OSA 5420

Sync Jack™

Timing distribution network

Highly scalable core grandmaster

Database timing at global scale

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Enhanced primary reference time clock

Ensemble Controller and Ensemble Sync Director

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Product specifications

Product variants

	OSA 5420 quartz	OSA 5420 quartz HQ+	OSA 5421 quartz HQ++	OSA 5421 rubidium
Clock	OCXO	OCXO	DOCXO	Rubidium
Expansion line cards	2	2	1	1
PSU	Hot-swappable redundant PSU (AC/DC)	Hot-swappable redundant PSU (AC/DC)	Hot-swappable redundant PSU (AC/DC)	Hot-swappable redundant PSU (AC/DC)

Main applications

- 1588v2 PTP grandmaster clock (up to 1024 PTP clients at 128pps)
- 1588v2 PTP boundary clock (up to 1024 PTP clients at 128pps), G.8273.2 BC type D
- 1588v2 APTS clock
- 1588v2 PTP slave clock
- GNSS receiver and PRC/PRTC including fan-out of multiple physical synchronization output interfaces
- Synchronization supply unit (SSU)
- NTP server
- Synchronization protocol and physical signal conversion
- Sync probe – Syncjack™ monitoring and assurance

PTP features

- PTP profiles support:
  - ITU-T G.8265.1 frequency delivery profile (IP unicast over IPv4/IPv6)
  - ITU-T G.8275.1 time/phase delivery profile (Full timing support - Ethernet multicast)
  - ITU-T G.8275.2 time/phase delivery profile (APTS)
  - PTP enterprise profile (mixed multicast and unicast over IPv4/IPv6)
  - IEEE 1588 2008 PTP default profile over IPv4/IPv6 multicast
  - IEEE 1588 2008 PTP default profile over Ethernet multicast (Annex F)
  - PTP power and utility profiles: IEC/IEEE 61850-9-3, IEEE C37.238-2011, IEEE C37.238-2017

- PTP Broadcast and media profiles: SMPTE ST2059-2, AED67
- 1-step and 2-step clock
- Up to 16 master/BC IP addresses
- Up to 16 VLANs (IEEE 802.1Q customer-tagged) and stacked VLANs
- Support for multiple profiles simultaneously
- Support for PTP IPv4/IPv6 on the same port
- Support PTP (TAI) and arbitrary (ARB) timescales
- Support master and slave on any port simultaneously
- Up to three stacked VLANs per flow (Q-in-Q service provider tagged)
- ICMP/DSCP/TOS
- Configurable static routes and default getaways
- Enhanced PTP GM/BC/slave statistics, performance monitoring (15min and 24h), threshold crossing alarm (TCA) and SNMP traps
- In-house best-in-class clock recovery algorithms
- DoS protection using hardware access control list (ACL) and traffic rate limiting
- Operates as single or double attached clock in PRP IEC 62439-3 network

NTP features

- Stratum 1 NTP server when locked to GNSS
- NTP v1, v2, v3, v4 and SNTP over IPv4/IPv6
- NTP unicast/multicast/broadcast
- Symmetric key and autokey authentication
- TIME & DAYTIME protocols
- NTP peering
- NTP selectable timescale (UTC/GNSS/local)
- Hardware timestamping

- Accuracy within +/−100nsec from UTC
- Up to 16 NTP server IP addresses
- Support PTP and NTP on same Ethernet port
- PTP to NTP translation
- Up to three stacked VLANs per flow (Q-in-Q service provider tagged)
- Enhanced NTP statistics and client lists
- Up to 8000 transactions per second (when configured as NTP server without PTP/Syncjack™)
- PTP backup in case of GNSS outage

Synchronization interfaces (onboard)

- Synchronous Ethernet (SyncE) over FE/GbE interfaces
- 1x BITS-in and 1x BITS-out (2.048MHz, E1 or T1 (DS1) including SSM)
- 1x PPS in/out and 1x PPS in
- 1x time-of-day (ToD) + PPS in/out
- 1x CLK in (2.048/10MHz)/out(10MHz) and 1x CLK (2.048/10MHz) in
- Antenna input for embedded GNSS receiver

4x Ethernet ports

- Hardware-based timestamping (PTP & NTP)
- Two combo 100/1000BaseT or 100/1000BaseX (SFP) ports
- Two additional 100/1000BaseX (SFP) ports
- All fiber ports support SM/MM colored/non-colored SFP and copper SFP
- Per-flow hardware-based policing and scheduling
- Configurable link asymmetry delay compensation

Synchronous Ethernet (SyncE)

- Supported by all Ethernet interfaces in fiber and copper modes
- Compliant to ITU-T G.8261/G.8262/G.8264
- Ethernet synchronization message channel (ESMC)
- Sync-E for time holdover during GNSS outage

BITS in/out

- 1x BITS input over shielded RJ-48
- 1x BITS output over shielded RJ-48
- User-configurable: E1, T1 (DS1), 2.048MHz
- G.823 / G.824 sync interface compliant
- Synchronization status message (SSM)
- BITS input for time holdover during GNSS outage
- Output squelch option
- SSU filtering option

PPS in/out, PPS in

- 1x PPS input
- 1x PPS input/output (user configurable)
- User configurable input and output delay compensation
- SMA-F connector (50ohm)
- Output squelch option

Time-of-day (ToD+PPS) in/out

- G.8271 compliant
- ToD formats – NMEA 0183 ($GPZDA sentence), ITU-T G.8271 and CCSA
- RS422 over shielded RJ-45
- Output squelch option
- GNSS receiver
- Multi-constellation GNSS L1 32 channels receiver
- Skyview and GNSS satellites status
- Configurable SNR, elevation and PDOP masks
- User-configurable antenna cable delay compensation
- Support fix positioning – single satellite mode
- Software configurable mode of operation
  - GPS (1575.42MHz)
  - GLONASS (1601.5MHz)
  - BEIDOU (1561MHz)
  - GALILEO (1575.42 MHz)
  - Combined GPS + GLONASS
  - Combined GPS + BEIDOU
  - Combined GPS + GALILEO
- Voltage to antenna +5VDC
- Antenna connector SMA-F (50ohm)

CLK in/out, CLK in

- 1x CLK (2.048/10MHz 10MHz) input
- 1x CLK 10MHz (2.048/10MHz MHz) input / output (10MHz)(user configurable)
- SMA-F connector (50ohm)
- Output squelch option

Output expansion line cards

- OSA 5420 – Up to two expansion cards
- OSA 5421 – One expansion card
- Hot insertion / extraction support
- Overvoltage / current protection
- Two expansion cards share a single mountable patch panel with 16xRJ-48 / RJ-45 and 16xBNC connector options

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GNSS receiver

Line cards	16x BITS	16x CLK / PPS	16x PPS+ToD	4x 1G	IRIG
Capabilities	16x BITS outputs over high density connector (VHDCI) – supporting 2.048MHz, E1 or T1 (DS1). Per output configurable signals type (E1, 2.048MHz)	16x clock 10MHz or 5MHz outputs over unbalanced 50ohm interface or 16x PPS outputs over unbalanced 50ohm interface	16x PPS+ToD outputs over balanced interface	4x 100/1000bit/s Ethernet ports (PTP / NTP / Sync-E) Sync-E and PTP monitoring and assurance using Syncjack™	1x IRIG isolated input 1x IRIG optical output Alarm/pulse relay RS422 output 10x IRIG outputs

Holdover performance

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

* Note: Effective daily aging after device has been powered for one month and locked to GPS for three days, for the following three days
**Note: effective temperature stability after compensation

	200nsec	400nsec	1.1usec	1.5usec	5usec	10usec	16ppb
Quartz	1 hours	2 hours	4 hours	5 hours	8 hours	14 hours	1 month
Quartz HQ+	4 hours	8 hours	14.5 hours	16.5 hours	1.5 days	2 days	0.5 years
Quartz HQ++	10 hours	17 hours	1.5 days	2.2 days	4.4 days	6.6 days	>1.5 years
Rubidium	1 day	1.8 days	3.5 days	4 days	8 days	12 days	>5 years

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.

Sync signal conversion

From / To	SyncE Tx	BITS OUT	CLK OUT (10MHz)	PTP	NTP	PPS OUT	ToD
GPS/GNSS	✓	✓	✓	✓	✓	✓	✓
SyncE Rx	✓	✓	✓	✓	n/a	freq.	n/a
BITS IN	✓	✓	✓	✓	n/a	freq.	n/a
CLK IN	✓	✓	✓	✓	n/a	freq.	n/a
PPS IN	✓	✓	✓	✓	✓	✓	✓
PTP	✓	✓	✓	✓	✓	✓	✓

GM / PRTC frequency and time accuracy

- While locked to GNSS:
- Phase and time – PRTC / G.8272 phase accuracy (±100nsec from UTC)
- Frequency – PRC / G.811 frequency accuracy

Assured PNT (aPNT) solution

- Multiple backups to GNSS including PTP, SyncE, CLK, BITS and local oscillator
- PRTC can automatically select between 3 available input references
- Frequency automatically selected between 2 available input frequency references
- Improved holdover with HQ+/HQ++/rubidium oscillator
- ePRTC combines GNSS/PTP/PPS+ToD with cesium clock from improved accuracy in locked mode and extended holdover in case of GNSS outage
- Interoperable with OSA 5405 smart antenna
- PTP and GNSS assurance using ENC Sync Director

Syncjack™ monitoring and assurance tools

- Clock accuracy for up to two clock probes – computing TE, TIE and MTIE of physical clocks
  - Calculation of maximum, constant and dynamic TE, TIE and MTIE between physical source and reference signals
  - Programmable source and reference signals including SyncE, BITS, PPS, GNSS and CLK
  - MTIE mask and time error threshold alarms based on SNMP traps
  - TE/TIE raw data collection and export to server
  - Daily MTIE and TE performance monitoring reports
- Clock analysis for up to four PTP clock probes – packet TE, TIE and MTIE
  - Calculation of packet maximum, constant and dynamic TE, TIE and MTIE between physical reference signal and timestamps within the PTP packets
  - Support for active and passive probe mode
  - Programmable reference signals including SyncE, BITS, PPS, GNSS and CLK
  - MTIE mask and Time Error threshold alarms based on SNMP traps
  - TE/TIE raw data collection and export to server
  - Daily MTIE and TE performance monitoring reports

- PTP network analysis including PTP network probe
  - Packet delay and packet delay variation performance statistics
  - Delay asymmetry
  - Network usability statistics (FPP based on G.8261.1)
  - Packet loss statistics
  - Programmable reference signals including SyncE, BITS, PPS, GNSS and CLK
- All probes include enhanced sync assurance statistics, performance monitoring (15min & 24h), including data export, threshold crossing alarm (TCA) and SNMP traps
- User-configurable MTIE masks

Low-touch provisioning

- Text-based configuration files
- FTP/SFTP/SCP for configuration file copy
- Remote software upgrade

Management and security

Local management

- Serial port (RS232 over RJ45) for CLI

Remote management

- Local LAN port (10/100BaseT over RJ45) using CLI, SNMP and Web GUI interfaces
- Support for IPv4 and IPv6
- Barrier free GUI
- Maintains in-band VLAN and MAC-based management tunnels
- Static routes & configuration of default getaways
- Fully interoperable with Adtran FSP 150 and Adtran FSP 3000 products
- Supported by Ensemble Controller, including Ensemble Sync Director and GNSS assurance

Management protocols

- Telnet, SSH (v1 / v2)
- HTTP / HTTPS (TLS 1.2)
- SNMP (v1 / v2c / v3)

Secure administration

- Configuration database backup and restore
- System software download via FTP, HTTPS, SFTP or SCP (dual flash banks)
- Remote authentication via RADIUS/TACACS+
- SNMPv3 with authentication and encryption
- Access control list (ACL)
- ICMP filtering and rate limiting
- Automatic certificate enrollment with full integration into PKI

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IP networking

- DHCP
- ARP cache access control
- RIPv2 and static routes
- IPv6 NDP address resolution
- RIPng for IPv6
- ICMP

System logging

- Syslog, alarm log, audit log and security log
- Configurable system timing source – local / NTP / PTP / PRTC (GNSS)
- User configurable time zone & daylight saving time

Standards compliance

- ITU-T G.8261, G.8262, G.8264, G.703, G.704, G.781, G.812
- ITU-T G.8272, G.8273.2
- ITU-T G.8265.1, G.8275.1, G.8275.2
- IEEE 1588v2 (PTP), 802.1Q (VLAN), 802.1ad, 802.1p (Priority)
- RFC 2863 (IF-MIB), RFC 2865 (RADIUS), RFC 2819 (RMON)
- RFC 1059 (NTPv1), RFC 1119 (NTPv2), RFC 1305 (NTPv3), RFC 5905 (NTPv4), RFC 4330 (SNTPv4)

Regulatory compliance

- CE compliance
- RoHS compliance
- NEBS level 3 compliance
- Power: ETSI 300 132-2, BTNR2511, ETS 300-019, ETS 300-019-2-[1,2,3], ANSI C84.1-1989
- Safety: EN 60950-1, 21CFR1040.10, EN 60825
- EMI: EN 55022 2010 Class A, EN 61000-3-2-2006, EN 61000-3-3 2008, EN 300 386 v1.6.1 2012, FCC 47FR Part 15 2014 Class A, ICES-002 2012 Class A

Power supply

- Hot-swappable, modular AC-PSU: 100 to 240VAC (47 to 63Hz) with over-voltage and over-current protection
- Hot-swappable, modular DC-PSU: -48 to -60VDC (tolerate -36 to -72VDC) with over-voltage and over-current protection
- Power consumption (without LC or SFP; Vin=48V):
  - OSA 5420 Quartz: 20W (typical), 22W (max.)
  - OSA 5420 Quartz HQ+: 25W (typical), 35W (max.)
  - OSA 5421 Quartz HQ++: 25W (typical), 35W (max.)
  - OSA 5421 Rubidium: 28W (typical), 41W (max.)

Environmental

- Dimensions: 443mm x 44mm x 219mm / 17.44" x 1.73" x 8.62" (W x H x D), ETSI-complaint
- Weight: 3.2Kg
- Operating temperature (ambient):
  - Quartz, Quartz HQ+, Quartz HQ++: AC: -40 to +50°C / DC: -40 to +65°C (hardened environment)
  - Rubidium: -40 to +45°C
- Storage temperature: -40 to +70°C (GR-63-CORE)
- Humidity: 5 to 100% (with condensation)

Optional accessories

- GNSS (GPS / GLONASS/BEIDOU/GALILEO) antenna kits 10 / 20 / 60 / 120 / 150m (32.8ft / 65.6ft / 196.85ft / 393.7ft / 492.1ft), including indoor and outdoor cables, roof antenna, lighting protector and mounting kit
- 1:2 / 1:4 / 1:8 GNSS (GPS/ GLONASS/BEIDOU/GALILEO) splitters
- Anti-jamming/anti-spoofing single band GNSS (GPS/ GLONASS/BEIDOU/ GALILEO/SBAS/QZSS) antenna
- GNSS window antenna
- Cables and adapters accessory kit
- Patch panels for BITS / CLK / PPS / PPS+ToD / IRIG